The Welding Engineer

Founded by L. B. Mackenzie, 1916

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HIGH PURITY OXYGEN

OXYGEN buyers should specify the percentage of purity in their contracts, and insist that deliveries are continuously up to specifications.

Airco high purity oxygen can be bought that way —Why buy oxygen any other way? — we prefer to sell it on that basis.

Any Airco representative will inform the buyer how oxygen may be tested and full cylinder contents determined by simple methods.

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Air Reduction Sales Company

Home Office: 342 Madison Avenue, New York City

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12 Airco Acetylene Plants
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72 Airco Distributing Points

Airco Apparatus Factories and Laboratories at Jersey City and Elizabethport, N. J.

ANYTHING and EVERYTHING for OXYACETYLENE WELDING and CUTTING

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Do you cut cast iron with a flame?

Cutting a cast iron gear wheel is only one of the many cutting operations that can be performed by means of the oxy-acetylene flame.

The Easiest Way

THE EASIEST WAY to cut cast iron is by the oxy-acetylene process as developed by Oxweld. Every day Oxweld customers and Oxweld fieldmen are finding new applications of oxy-acetylene cutting. A few of these many applications are cutting sections for demolition and plant changes; beveling broken parts for welding; emergency wrecking to facilitate repair; cutting away debris to speed up reconstruction; salvaging valuable parts by cutting away cast iron retaining sections; cutting floor plates; cutting blast furnace hearth cooling plates; cutting cast iron columns and other structural members; cutting bolt holes; cutting large cast iron scrap to charging box sizes, etc.

IT HAS now been several years since our discovery of a practical method of cutting cast iron by the oxy-acetylene flame. This method was first discovered in the field. It was then perfected in the Oxweld laboratories, and since has been demonstrated and taught by Oxweld fieldmen to thousands of our customers' operators all over the country.

Teaching operators how to cut cast iron by the oxy-acetylene method is just one of many services rendered customers by Oxweld fieldmen.

One of the advantages gained in purchasing Oxweld apparatus lies in the fact that Oxweld fieldmen will constantly bring you new ideas and new methods. In this work each fieldman has the benefit of the knowledge of all Oxweld fieldmen and engineers, and back of them is Oxweld's large research and experimental laboratory. And still Oxweld apparatus requires only a moderate investment.

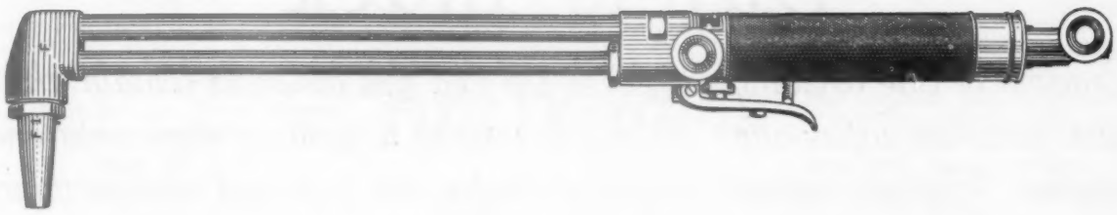
OXWELD ACETYLENE COMPANY

Chicago, 3642 Jasper Place — Long Island City, N.Y., Thompson Ave. & Orton St. — San Francisco, 1050 Mission Street

Oxweld

WELDING AND CUTTING APPARATUS

WORLD'S LARGEST MANUFACTURERS OF WELDING AND CUTTING EQUIPMENT



"MORE POWER TO YOU"

WHEN a Purox salesman sells you one of the new Style "E" or Style "F" Purox cutting torches, he is giving "more power to you"—a lot more power than a cutting torch has ever provided before.

These new torches operate on any oxygen — fuel-gas combination and can be used, in emergencies, for welding as well as for cutting.

You ought to know all about these remarkable new cutting and welding tools. Ask the nearest Purox office today for a copy of the folder "More Power to You".

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Representatives throughout the United States, Canada and Mexico

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
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See "Torches"

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Electric Arc Cutting & Welding Co.

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Modern Engineering Co.
United States Welding Co.

Rochester Welding Works

We not only do welding, but supervise the design and installation of oxy-acetylene welding plants; report on welding material and methods; make tests on welding apparatus for efficiency and economy.

Nine years' experience.

Rochester Welding Works
349 Orchard St., Rochester, N.Y

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Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

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Carbic Mfg. Co.
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Burdett Oxygen Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.

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Wodack Electric Tool Corporation

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Carbic Mfg. Co.
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Shawinigan Products Corp.
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CARBIDE (Compressed in Cakes)
Carbic Mfg. Co.

CARBON (Blocks, Paste, Etc.)
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National Carbon Co.
U. S. Welding Co.
Electric Arc Cutting & Welding Co.
Oxweld Acetylene Co.

CARBON REMOVING TORCHES
See "Torches"

CAST IRON FILLER RODS AND FLUX
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Bierman-Everett Foundry Co.
Carbic Mfg. Co.
Chemical Treatment Company
Central Steel & Wire Co.
Chicago Steel & Wire Co.
Wm. Cramp & Sons
Davis-Bournonville Co.
Electric Arc Welding & Cutting Co.
International Oxygen Co.
Modern Engineering Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Purox Co.
Imperial Brass Mfg. Co.
Page Steel & Wire Co.
John A. Roebling's Sons Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
Transportation Engineering Corp.
United States Welding Co.
Weldit Acetylene Co.

COPPER FLUX
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Bierman-Everett Foundry Co.
Carbic Mfg. Co.
Chemical Treatment Company
Davis-Bournonville Co.
Oxweld Acetylene Co.
Purox Co.
Imperial Brass Mfg. Co.
Weldit Acetylene Co.

CUTTING RODS (Elec. Arc)
Electric Arc Cutting & Welding Co.

CYLINDERS
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General Electric Co.
Quasi-Arc Weldrode Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

ELECTRODE HOLDERS
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Electric Arc Welding & Cutting Co
General Electric Co.
Gibb Instrument Co.
Quasi-Arc Weldtrode Co.
Stoody Co.

No. 4

Grade Color "GREEN"

Size: 5/32" Diameter

For Flat, Vertical and Overhead Welding

This wire will produce an extremely hard surface on steel and is not machineable. For use where resistance to wear is an important factor.

Guides, Rock-Crusher Jaws, Frogs, Rail Heads and Switch Points.

No. 6

Grade Color "WHITE"

Sizes: 5/32" Diameter
⅛" Diameter

For Flat, Vertical and Overhead Welding

This wire will produce a weld in steel of about 50,000 to 60,000 lbs. per square inch tensile strength and of medium ductility.

for

Arc Welding

Specify

No. 9

Grade Color "BLUE"

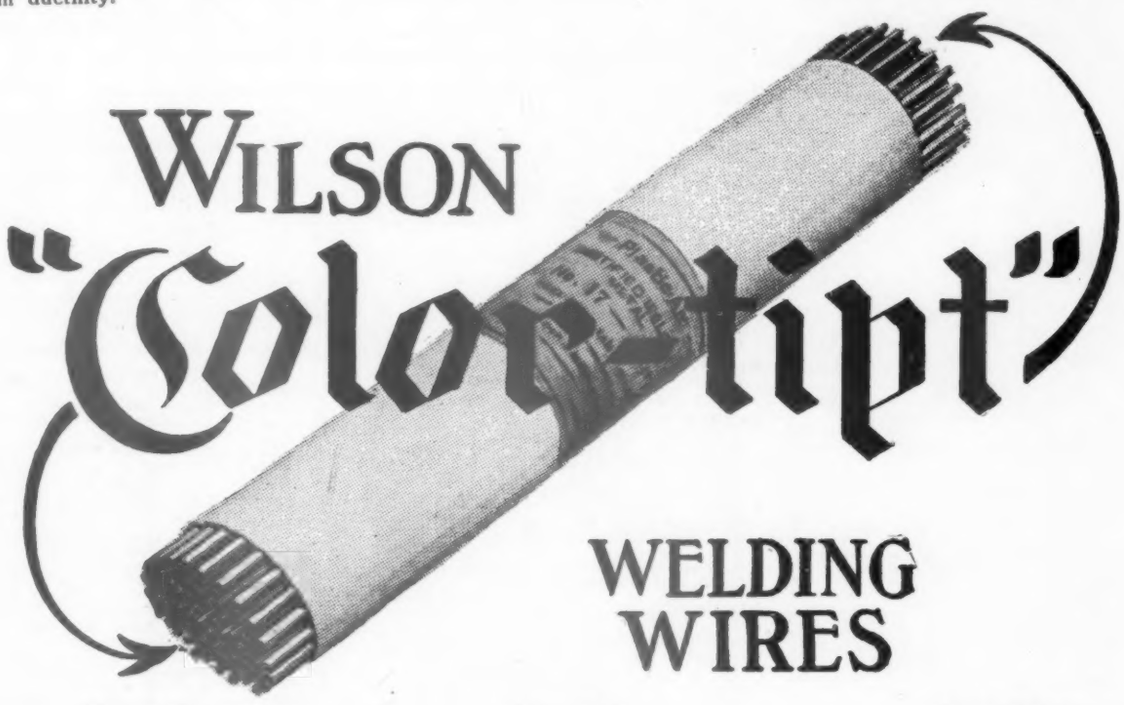
Sizes: 3/16" Diameter
5/32" Diameter
⅛" Diameter

For Flat, Vertical and Overhead Welding

This wire will produce a weld in steel of over 60,000 lbs. per square inch tensile strength and an elongation of about 15% in one inch in a mechanically sound weld. Machineable at reduced tool speed.

Automobile Frames, Boiler Plate, Cast Steel Parts, Locomotive Frames, Firebox Seams, Flue Sheet Patches, High Pressure Boiler Work, Oil, Gas and Steam Pipes, Ship Plates, Tanks, Fish Plates, and Rail Bonds.

WILSON "Color-tipt" WELDING WIRES



No. 17

Grade Color "RED"

Sizes: ¼" Diameter
3/16" Diameter
5/32" Diameter
⅛" Diameter
3/32" Diameter

For Flat, Vertical and Overhead Welding

This wire will produce a sound weld in cast iron where studs are used and in steel a weld of about 50,000 to 55,000 lbs. per square inch tensile strength. On steel is easily machineable.

Flue Work, Steel Castings, Blow Holes in Grey Iron Castings.

No. 12

Grade Color "GREY"

Sizes: 5/32" Diameter
⅛" Diameter
3/32" Diameter

For Flat Welding Only

This wire will penetrate cast iron and produce a homogeneous and machineable weld. Readily caulked when cold.

Monel Metal—Wilson Processed

Sizes: 5/32" Diameter
⅛" Diameter
3/32" Diameter

For Welding Monel Metal and Monel to Steel.

No. 20

Grade Color "BROWN"

Sizes: 5/32" Diameter
⅛" Diameter

For Flat Welding Only

This wire will produce a weld in brass, bronze, and light gauge copper.

Pump Castings, Water Wheels, Motor End Rings, Tail Shaft Sleeves, Bearings, and Castings.

No. 50

Grade Color "ALUMINUM"

Size: 5/32" Diameter

For Welding Sheet Aluminum Minimum No. 11 gauge (⅛"), also for Cast Aluminum minimum thickness 3/16".

WILSON WELDER & METALS CO. INC.

HOBOKEN, NEW JERSEY

Transportation Engineering Corp.
Wilson Welder & Metals Co.

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International Oxygen Co.

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Bierman-Everett Foundry Co.
Burdett Oxygen Co.
Carbic Mfg. Co.
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Chicago Steel & Wire Co.
Wm. Cramp & Sons
Electric Arc Cutting & Welding Co.
Davis-Bournonville Co.
Modern Engineering Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Purox Co.
Page Steel & Wire Co.
Superior Oxy-Acetylene Machine Co.
Transportation Engineering Corp.

FILLER RODS (Tobin Bronze)
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American Brass Co.
Bierman-Everett Foundry Co.
Burdett Oxygen Co.
Central Steel & Wire Co.
Bierman-Everett Foundry Co.
Carbic Mfg. Co.
Davis-Bournonville Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Page Steel & Wire Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Weldit Acetylene Co.

FILLER RODS (Vanadium Steel)
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Burdett Oxygen Co.
Bierman-Everett Fdy. Co.
Carbic Mfg. Co.
Central Steel & Wire Co.
Universal Oxygen Co.
Wm. Cramp & Sons
Davis-Bournonville Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
Modern Engineering Co.
Purox Co.
Oxweld Acetylene Co.
Reid-Avery Co.
Torchweld Equipment Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.

FIREPROOF PLASTIC
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United States Welding Co.

FLUE WELDERS (Electric)
General Electric Co.

FLUXES
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Bierman-Everett Foundry Co.
Carbic Mfg. Co.
Chemical Treatment Co.
Davis-Bournonville Co.
Imperial Brass Mfg. Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Weldit Acetylene Co.

FURNACES (Annealing)
Buffalo Dental Mfg. Co.
General Electric Co.

GAS BURNERS (Preheating)
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Davis-Bournonville Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.

GAUGES
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Oxweld Acetylene Co.

GENERATORS (Acetylene)
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American Brass Co.
Bastian-Blessing Co.
Carbic Mfg. Co.
Davis-Bournonville Co.
Imperial Brass Mfg. Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Weldit Acetylene Co.

GENERATORS (Oxygen or Hydrogen)
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Gas Products Assn.
International Oxygen Co.
Oxweld Acetylene Co.

GLOVES (Welders' Asbestos)
Air Reduction Sales Co.
Burdett Oxygen Co.
Carbic Mfg. Co.
Davis-Bournonville Co.
Electric Arc Cutting & Welding Co.
Ideal Face Shield Co.
International Oxygen Co.
Imperial Brass Mfg. Co.
Purox Co.
Torchweld Equipment Co.
Weldit Acetylene Co.

GOGGLES
Air Reduction Sales Co.
Bastian-Blessing Co.
Carbic Mfg. Co.
Chicago Eye Shield Co.
Ideal Face Shield Co.
Davis-Bournonville Co.
Imperial Brass Mfg. Co.
Modern Engineering Co.
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Purox Co.
Quasi-Arc Weldtrode Co.
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International Oxygen Co.
Imperial Brass Mfg. Co.
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Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Weldit Acetylene Co.

HOSE UNIONS
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Davis-Bournonville Co.
Harris Calorific Co.
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International Oxygen Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

HYDROGEN
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Gas Products Association
International Oxygen Co.

HYDROGEN PLANTS
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International Oxygen Co.

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Burdett Oxygen Co.
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Davis-Bournonville Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

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Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.

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Harris Calorific Co.
International Oxygen Co.
Imperial Brass Mfg. Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
U. S. Gauge Co.
Torchweld Equipment Co.
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Reamers Portable Electric

REAMERS, PORTABLE ELECTRIC
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Wodack Electric Tool Corporation

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Harris Calorific Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Weldit Acetylene Co.

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International Oxygen Co.
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Modern Engineering Co.
K-G Welding & Cutting Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

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Davis-Bournonville Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Purox Co.
Weldit Acetylene Co.

SAND BLAST
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Burdett Oxygen Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
International Oxygen Co.
Modern Engineering Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

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Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
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United States Welding Co.
Weldit Acetylene Co.

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Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
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Burdett Oxygen Co.
Davis-Bournonville Co.
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Oxweld Acetylene Co.
Modern Engineering Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
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WORLD'S BEST QUALITY—HIGHEST GAS YIELD

ALWAYS PACKED IN BLUE AND GRAY DRUMS

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Requests for information and special correspondence should be addressed to our New York, Chicago or San Francisco offices.

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Packed in 100 Pound Drums

3½ in. x 2 in. (Lump)
2 in. x ½ in. (Egg)
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¼ in. x 1/12 in. (Quarter)

For Oxy-Acetylene Welding and Cutting Plants, Acetylene House Lighting and Cooking Plants, Contractors' Torches and Flare Lights, and numerous other pieces of Acetylene generating apparatus designed for the use of one of these sizes of Carbide.

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Peoples Gas Building
Chicago, Ill.

Carbide and Carbon Building
30 East 42nd St.
New York

Balfour Building
California and Sansome Sts.
San Francisco, Calif.

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San Francisco....Balfour Bldg., 351 California St.

COLORADO
Denver....Nineteenth and Wazee Sts.

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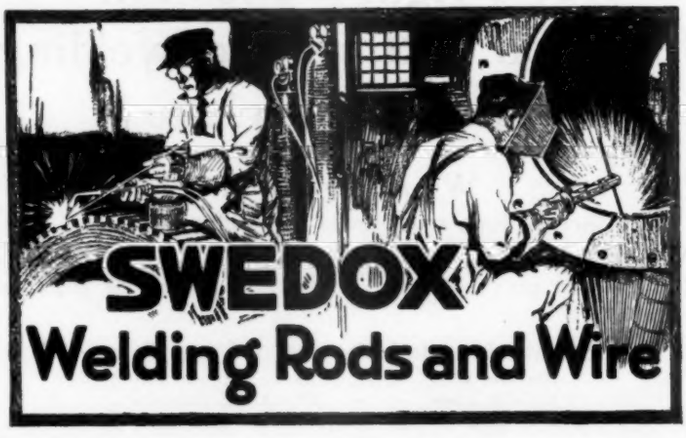

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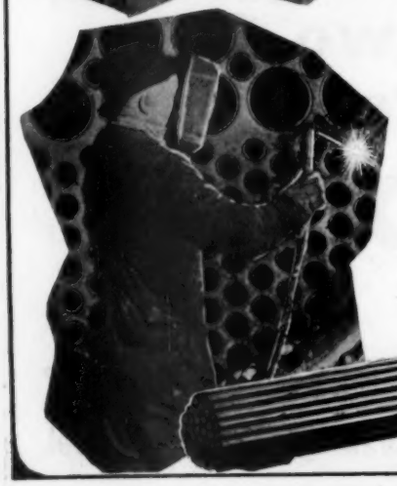

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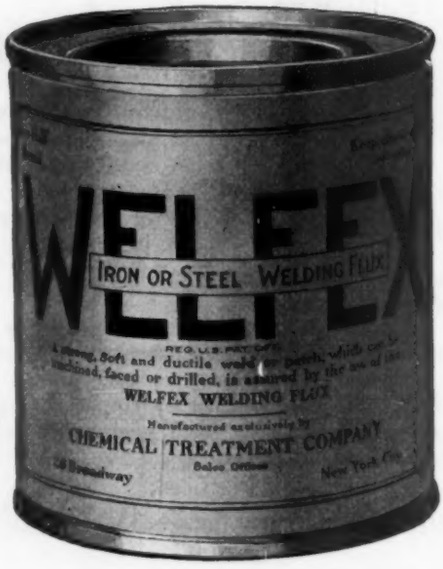

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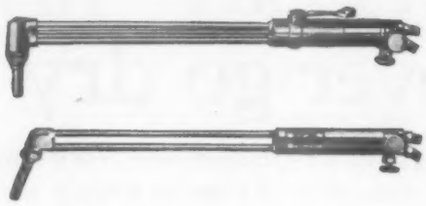

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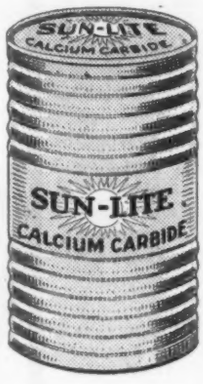

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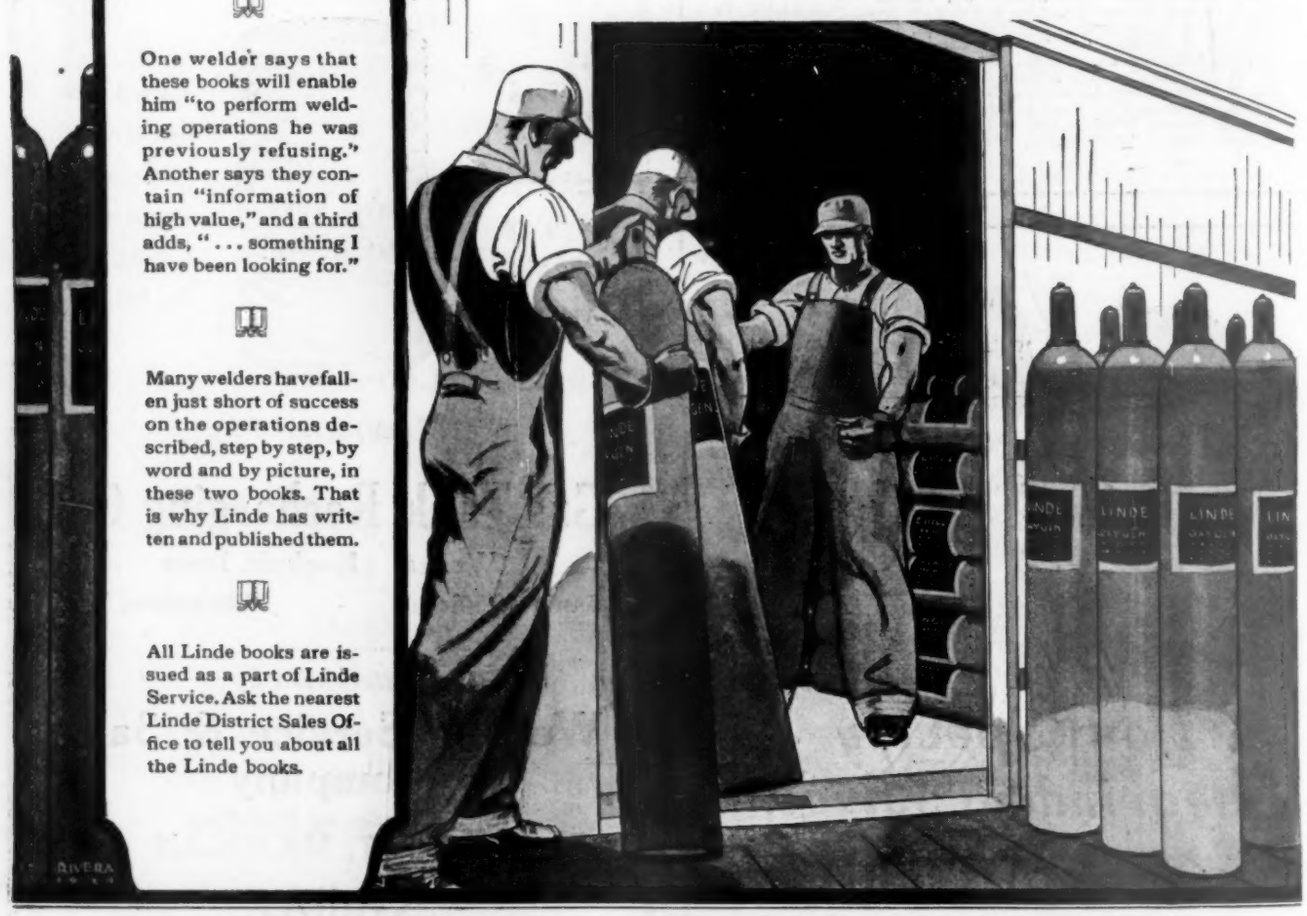

LINDE OXYGEN

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Why The Flux-Coated Electrode?*

Advantages to be Gained for the Weld Through the Protection of the Electrode Metal

By C. J. Holslag†

IT is a well-known fact that high temperatures are invariably favorable to a chemical reaction. Consequently the temperature generated by the electric arc, which will melt refractory metals with ease in an instant, and is the highest temperature that can be produced, would naturally greatly encourage any tendency towards a chemical reaction. The first reaction is the universal chemical reaction—oxidation, and it will occur readily if the melting process takes place in air or anywhere in the presence of oxygen. There are many other chemical and physical changes due to the arc, such as the formation of compounds of carbon and nitrogen, furthered by the high temperature of the arc, which are undesirable in the completed arc deposit. The problem, therefore, that confronts the welding operation, or any process in which the melting of metal is concerned, is to prevent as far as possible the partial combination of the molten metal with oxygen and nitrogen; in other words, to avoid the formation of metallic oxides and nitrides. These compounds are, in general, very detrimental to the success of welding or casting, because they form inert, impervious and brittle mass which are liable to become entrapped in the weld, creating weak and imperfect sections. Therefore, any agent which will act to prevent their formation in the melting and welding of metal is highly desirable. The greatest of these aids is found in the use of the various kinds of fluxes.

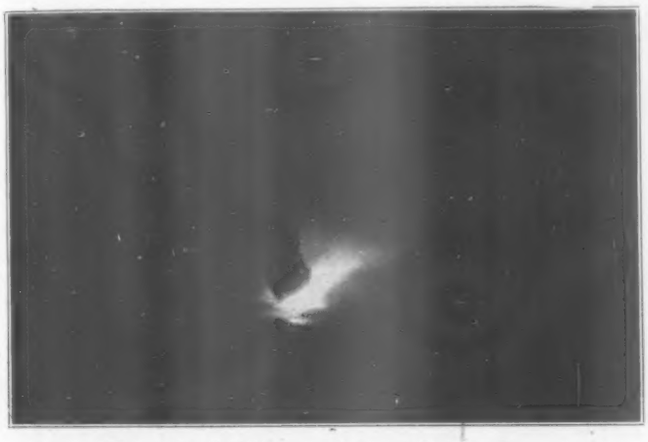

Fig. 1—English type, or slag-coated electrode

The chief problem is, primarily, to shield the molten metal as far as possible from contact with the air, and then to dispose of whatever oxides or nitrides have unavoidably formed. If the proper fluxes are chosen, both these conditions may be thoroughly realized. If it is possible to surround the active weld with an inert mass that will melt at the temperature of the arc but will not combine with the air, the molten metal will then be prevented from coming in contact with the air, and oxidation be greatly reduced. This is actually the condition realized in the use of the slag-coated electrode. This special electrode has a coating of such thickness and quantity as to melt at a steady rate with the melting of the electrode tip, and to form an envelope at all times about the arc and the molten puddle. A coating such as this may be of slag, asbestos, or various silicates, in short, any material that may be used as a coating, and will not combine with oxygen. The drawback to this type of coating is that the slag is liable to become entrapped in the weld and in protecting the deposit from microscopic impurities real deposits of slag may be found in the weld.

Besides this type of dead, inert coating, the electrode may be coated with fluxes which are chemically active in a favorable way. These are valuable in other duties besides the all-important prevention of oxides and oxidation and they may be chosen to combine with and eliminate various undesirable elements in the welded metal itself or they may be effective in producing any desirable chemical composition in the deposited metal, or they may, as in soldering, act to clean the welding surfaces from dirt, grease or oxide. All these actions are, of course, favored by the heat of the arc, and may be combined in one coating of flux. It is well known, when welding with bare wire of any ferrous composition whatever, that the resultant weld is composed of pure iron, because the high temperature of the arc drives off the other ingredients as gases. It is the function of the flux to prevent this state of affairs, and it does prevent it in a most effective way. As a matter of fact, modern developments in flux coatings have made it possible to lay down deposited metal of a *predetermined composition*, so that it is now possible to duplicate in the weld such metals as manganese steel, high-carbon steel, and other steels of very special qualities impossible to deposit with the bare wire electrode, no matter what its composition.

The quality obtainable with the use of the flux coated electrodes make them more economical than those of bare wire. In no way is it possible with bare wire to make an arc weld possess any ductility or elongation. But with the flux coated electrode, it is possible to duplicate all the physical properties of cast steel—ductility, elongation, tensile strength, alternating stress, etc. In fact, tests made by the Interborough Lines of New York City in 1918 before a committee composed of Interborough engineers, engineers of the Public Service Commission, and of the City of New York, resulted in the verdict that such an electrode deposit possessed all the properties of good cast steel.

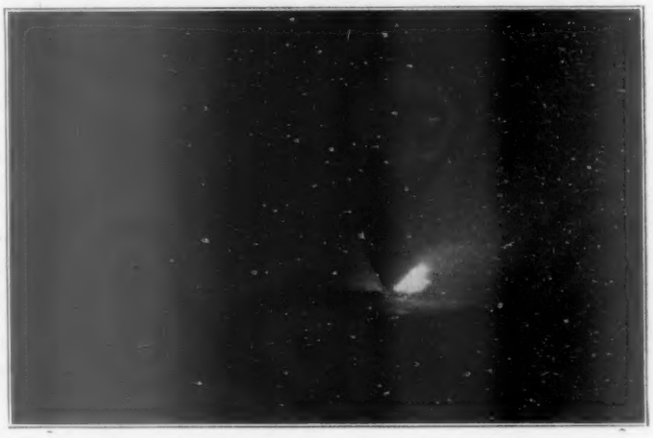

Fig. 2—American type, or flux-coated electrode

Likewise in August, 1919, the Wirt-Jones, tests showed that the properties of ductility and elongation were increased by fluxed electrodes as a result of the cold-bend test, and at no sacrifice to strength, because in each case the test piece broke outside the weld. With no other system was this true in those tests.

Fluxes are also useful in ridding the weld of such undesir-

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* *Paper Read Before Chicago Section, American Welding Society, Dec. 5, 1924.*

† *Electric Arc Cutting and Welding Co.*

able impurities as sulphur and phosphorous, both of which tend to produce a hard, brittle mass of metal in a weld. It is a fact to add that all desirable impurities such as managense and carbon burn out of the weld easily while sulphur and phosporous persist. This type of flux is usually composed largely of silicates, which readily combine with impurities and which, in addition, possess the advantage of forming the already-mentioned inert envelope about the arc.

In cast iron welding, a great modern development of the arc, the use of the flux is almost indispensible, in fact most of the improvements in cast iron welding have been due to the use of fluxed electrodes. This type of flux either unites with the excess of carbon in the cast iron, or tends to keep the hard carbon-iron compounds from forming. It is composed of a compound rich in carbon together with lime or other carbonide compound

Fig. 3—Bare wire welding

which becomes active under the heat of the arc and resupplies the free carbon which tends to keep the weld soft. In addition to this, the flux may contain nickel, silicon, manganese, or other compounds which prevent oxidation, tend to keep the weld molten, and bring about other desirable results. The flux coated steel electrode is of great assistance in all studding work, and any other work of a kind in which special conditions have to be met. A specially developed flux makes possible the use of an electrode actually made of cast iron. This flux provides for a quieting reagent, rapid floating of dross to the surface, absorption of oxygen or nitrogen, and a protection against rapid surface cooling. This is the highest development of which a flux is capable at present, and makes possible a weld with the iron electrode which possesses all the qualities of the original cast iron. Moreover, the use of this flux requires no special preparation, and a rod with this coating is deposited with only the usual care required in welding. Furthermore fluxcoated electrodes deposit faster for the same current because of the greater voltage across the arc caused by the coating.

It will be seen from this that for a multitude of uses there is no satisfactory substitute for the flux-covered electrode in arc welding. The flux coating not only aids in many special ways, but actually lowers the cost of the weld by its capabilities of greater speed of deposition and surer production of consistently desirable results. Of course a skilled operator with a bare wire electrode may hold a close arc so as to cut the oxidation down as much as possible, and produce passable results, but for general use in the hands of the average operator, the fluxed electrode is best, not only because it is capable of greatly improving the weld, but because it is easier to run, and allows the operator's attention to be directed at the work instead of on the electrode. With the use of bare wire, much time is inevitably wasted in chipping, sand-blasting and brushing to remove the excess oxide, and so laborious and inefficient is the process that most operators would no more use unfluxed wire than they would unfluxed solder. There are other ways of adding flux to a weld than by means of a coating on the electrode, but these methods are mostly ineffective. Granting that flux is beneficial at all, then surely the most logical way of introducing it into the weld is at a calculated rate through a coating on the electrode, not by throwing it at the weld at intervals, or by dipping the electrode tip into a keg or box every now and then. It is maintained that puddling the molten weld with an iron rod is effective in floating some of the oxide to the surface, but this is at best a puttering process and so impractical for arc welding that it cannot compare with the quick, sure action of a good flux.

Flux coated wire is speedier and more efficient than bare wire on three counts. First, it requires less brushing, preparation and interrupting of the actual welding operation; second, the voltage across the fluxed arc is higher than across the bare rod, and the amount of work done is directly proportional to the amount of energy liberated at the arc. Hence, for the same current, the arc is proportionately faster due to the higher voltage; and there is less spatter and unnecessary oxidation with the fluxed electrode because the arc is concentrated or focused like a stream coming from a nozzle, whereas, with the unfluxed electrode, the arc shows a tendency to widen, much in the same manner as water coming from a hose without a nozzle.

In addition to cleansing of the weld, fluxed electrodes are the only known way of adopting alloys on steel of any desired analysis, they have been the only advance made in cast iron welding and for ordinary welding they are not more costly because the increased electrode cost is far more than offset by the direct saving in labor not to mention the insurance of having the work done right the first time and always.

It had been found also that a greater proportion of the added metal is actually retained with flux coated electrodes than with bare electrodes. By comparing the weight of metal plus bare electrode before welding with the weight after welding, it has been shown that a portion of the electrode approximating 20 per cent is lost. With a flux covered electrode this loss is less than 5 per cent, indicating that more metal actually goes into the weld when using the coated electrode.

(To conclude, it should scarcely be necessary to defend the use of a flux coating at all. Every metal founder knows that without the proper fluxes he would be helpless, and could not produce a perfect casting. The electric arc welding process consists of casting metal on a small and highly concentrated scale, and is so

Fig. 4—Bare wire welding

benefited by the use of fluxes to an even greater extent. On some electrodes, the flux coating is thick and heavy, on others thin; still others are half-coated, so that the arc will be encouraged ahead when the electrode is used with the bare side advancing. The added advantage of this last type lies in the protection given to the already-welded metal by the curtain of flux which drops down behind the arc and protects it from oxidation. A very heavy flux coating has not been found necessary for ordinary welding purposes, although for cutting, where an excess of oxidation is desirable, the coating may be in excess to assist the reaction. The ordinary medium-fluxed wire, however, is most effective in producing welds of consistent excellence.)

Aluminun Welding, How And Why

A Shop Welder Cites Many Interesting Points to be Observed for Success in this Difficult Process

By S. W. Henderson

ALUMINUM welding is one of the most interesting as well as one of the most useful branches of the welding of metals. Especially is this so in a city shop where customers bring broken parts for welding, men and women with household fixtures, auto owners, garage and service men from all different lines of business.

To turn out guaranteed work a welder must know quite a bit about the metal, and must know the different alloys—(Al+Zn), (Al+Cu), common 92-8 mixture, or 93% aluminum and 7% copper, die casting, auto specialties, heavy with zinc, etc. The welder must also know when it is safer to solder than to weld.

Soldering is used where the excess heat of welding would warp or otherwise spoil the part, say in a Cole Eight intake manifold that has a duplex chamber, the outer for water from the radiator and the inner for intake gases. Welding, when the metal is heavy, and there are no thin sections, can be advantageously used.

In aluminum welding a welder should know the specific heat (0.22) for pure aluminum and (0.28 approximately) for aluminum copper alloy. Specific heat is the amount of heat that a piece of metal will absorb in being raised from the ordinary state to the melting point. When reckoning specific heat it must be borne in mind that some goes to the piece of metal in raising it to the melting point and the rest of it goes to do interior work such as overcoming the cohesion of the molecules in the metal so that they may take new positions.

In aluminum welding conductivity is closely related to specific heat. Aluminum conductivity is 0.524 (copper as a standard—1.00), due to the fact that aluminum conducts heat more than one-half as fast as copper. We have to use as large a tip as for steel because while steel has a melting point of 2,600 degrees F., to 2,700 degrees F., its specific heat is .117 and its conductivity .118. Aluminum is 1,200 degrees F. to 1,220 degrees F., but so much more heat is radiated and passed through the mass that we have to use a larger tip than 1,200 degrees F. would ordinarily call for. Aluminum is a granular metal, except when drawn, rolled or hammered, which process is accomplished only by frequent annealing. While being worked its specific gravity is increased to 2.68 and a break is fiberous.

As cast aluminum is granular the cohesion of the grains near the melting point of the metal is weak. All castings of any weight, or with weights suspended near the points of welding, should be supported so as to prevent warping of the hot parts. A casting should always be well supported and level so that in no way is any strain put on the weld while it is being made, or after it is made, until the casting has completely cooled.

A great many welders do not always follow this practice and handle the casting carelessly, turning and twisting it so as to better finish the work, and they almost always find that to some extent the casting is warped. Frequently this is blamed on poor metal, but individual carelessness is just as often the cause.

Of course, in the case of Buick, Overland, Continental, Essex and such types of crank case arms, the arms may be bricked to place and after the weld is already started the blocks may be removed. No special care in preheating is needed on any point, that is, at the end or on the outside of the casting, but the weld should never be put to a strain until cool.

Expansion and contraction of aluminum castings is approximately 11/64 of an inch per foot, but as a rule in crank case work and clutch covers, where parts are broken, at least ¼ of an inch gap is left to insure normal contraction. This is due partly to the conductivity of the metal and to the fact that on a one side weld the metal is pushed through in bubbles on the other side. Due to the heavy layer and higher heat the weld always pulls so that if set straight at the beginning the ends are bowed toward the weld. Also due to the high conductivity of the aluminum so much of the casting is heated that the added metal being expanded adds to the contraction on cooling.

In setting up for welding allowance should always be made to take care of the contracting pull of the hot metal and added metal—more so if the entire weld is to be made on one side only.

Some times when a piece is warped from welding, the welder may make another weld on the other side after the piece is cooled, called a phoney weld. It is but added metal at a place where the contracting strain will help straighten the castings. If it is a crank case the opposite side should be preheated somewhat to allow it to give.

In most cases it is better in welding cracks to tack a couple of places and begin the weld in the center of the crank. Otherwise the metal will come together and try to overlap. Starting at the center or nearly so, depending upon the nature of the work, a weld of an inch or two should be made, removing the metal at the crack either by scraping out or by heating enough to bring it almost to fluid form and pushing through to the other side with the filler rod. Then the sunken space should be filled with metal from the filler rod. If possible the casting should then be laid so that the welder can get a torch in to turn on the bubbles which have formed. When it is heated it is possible to smooth it up with the paddle. This will enable one to have the other side flush.

After working up the weld made on the outside, start at the center in the other direction for approximately the same distance and repeat as before. Some times it is possible to begin at the center and go to one extreme edge, then from the center to the other edge, all depending on the thickness and shape of the casting, but the above method will allow no warping.

If it is a section that is broken out and is only an inch or so in diameter it is generally better to make a piece to fit in very loosely. Tack this in position and if near one edge keep the edge heated with a preheating flame and weld slowly by laps. Cracks due to welding are very common to the work of many operators due to the fact that he does not consider conductivity. Often he welds one side flush, or even builds it up, and then turns the casting over and fills up the crack without pushing through to get good penetration. In doing this he causes the aluminum on the hot side to expand too rapidly for the portion on the cool side. Consequently it must crack.

Another cause of cracks is that frequently welders, after finishing a job, do not reheat the weld and the parts affected by the weld for the purpose of removing the strain caused by the rapid heat. Preheating and reheating should be done with a moderate temperature and with not too great air pressure.

Blind cracks are a great source of worry to welders, as they often recrack after welding. This is due to the fact that the welder has not carefully gone over the matter, determined the section of the casting to which the crack extended. In welding a blind crack it is necessary to determine the most likely line of travel of the crack to a flange or edge of the casting. If bad, tack after drawing it till the parts become normal or nearly so. Gauge what warping, if any, will be produced by the weld and set the crack to take care of that as nearly as possible. Then start a gentle heat at the flange towards which the crack extends, increasing the heat until you can char a pine stick on the work.

Start to weld from the side farthest from the heater flame

until you get almost to the end of the crack. Turn down the flame till it is almost out, to finish the weld. Some times it is best to reheat the entire weld slightly, leaving a slow flame from the prehcater to play at the flange, and graduate by periods until the flame is out. Have the work covered as soon as the weld is finished. If there is more than one crack work each one separately, but be careful to keep preheating unless the work gets too hot.

In welding aluminum, unless it is horizontal work and you have some way of holding the metal, never get it in fluid form like quick silver. The semi-fluid or half granular stage is better and is always used in vertical and overhead welding. Have the paddle clean and keep the slag off. With a good paddle a welder can make a job that hardly needs dressing up. A flat paddle made of ¼-inch welding rod flattened and another one slightly hooked are all that is needed.

Let the filler rod melt in the weld. Help it by rubbing or turning and keep the weld moving all the time. It takes more heat to start the weld than to finish it. If the work gets too fluid change the flame to a carbonizing flame. It will not hurt the work if the flame does not touch the molten metal. The heat is lower and you will not lose time as you would if you changed tips. It saves time as well as torch gas to preheat castings. It saves time and rewelding to reheat castings and to cover carefully until completely cooled.

INSTRUCTION IN OXY-ACETYLENE WELDING AT DUNWOODY INSTITUTE

By F. M. Keys

The story is told of a teacher in one of our public schools who, in the course of an examination he was conducting in advanced arithmetic, asked for a definition of the subject. "Arithmetic is the science of numbers and the art of computation," came the answer, promptly. "Very good," said the teacher. "Now tell me what is a science and what is an art?" No response. It is barely possible that some of us who are engaged in the "science and art of welding" fail to realize that as a science it is a classified knowledge and the art of welding is the application of that science. We are apt to think of it as a trade that we have "picked up."

Through the courtesy of Assistant Director R. M. Bass, the writer recently had an opportunity to visit one of the classes in oxy-acetylene welding at The William H. Dunwoody Institute in Minneapolis, and was impressed by the thorough manner in which the subject is taught, from both the theoretical and practical standpoints. Every student seemed to realize that he was there for the purpose of acquiring the fundamental principles of a science and the skill to practice it as an art.

With an endowment of nearly five million dollars, the William Hood Dunwoody Industrial Institute offers "Free Instruction in the Industrial and Mechanical Arts to the Youth of the City of Minneapolis and of the State of Minnesota." In carrying out the wishes of its founder, the school is helping young men to prepare themselves for their chosen work and also offers an opportunity to ambitious men "already engaged in industrial and mechanical arts to improve themselves in their craft." Over 33,000 have attended the school and it will not be ten years old until December of this year.

Three classes in oxy-acetylene welding meet one evening each week, four hours per evening, under the direction of Instructor P. H. Gagnon. Welding tables and torches are provided for twenty men. Fifty lessons in welding are given each student at a cost to him of $5.00 for registration and $10.00 for laboratory fee. Two hundred hours of instruction and use of torch and gases for only seven and one-half cents per hour.

As outlined by the bulletin, the course is divided into two years work, units 1, 2, and 3, being the first year, and units 4, 5, and 6, the advanced second year:

W-1. Welding apparatus, operation and shop equipment (including various kinds of welding torches, regulators, gauges and equipment, adjustment of flames, operating of the generating outfit and theory of oxy-acetylene welding), 10 lessons.

W-2. Cast iron welding (including various methods of preheating, handling of large castings, welding various kinds of cast iron and actual shop practice), 20 lessons.

W-3. Steel welding (including method of preheating where necessary, welding large sheets of steel, method of testing welds and modern equipment in steel welding), 20 lessons.

W-4. Malleables, brazing and brass welding (including precaution necessary in welding malleable castings, method of brazing various materials and brass welding), 20 lessons.

W-5. Aluminum welding (including various methods of preheating and welding of aluminum castings), 20 lessons.

W-6. Oxy-acetylene cutting (including handling of various kinds of cutting torches, methods of cutting small and large work and precaution necessary in the cutting), 10 lessons.

The above unit courses are open to mechanics who are actually employed in work in which welding is being done, or to those who can show that they will profit by instruction received in this work.

The courses as mentioned above consist of three quarters actual shop work which deals with the handling of the torch and welding of the various kinds of metals, the other one-quarter of the time being spent in classroom work where the theory of welding is taken up and demonstrations made illustrating the various kinds of equipment.

ENGINEERING FOUNDATION ENDOWMENT INCREASED

By the will of Henry R. Towne, who died October 16, the endowment of Engineering Foundation is increased $50,000. This sum is bequeathed to United Engineering Society as the trustee of the Engineering Foundation funds for the four National Societies of Civil, Mining, Mechanical and Electrical Engineers.

This bequest esetablishes the Henry R. Towne Engineering Fund, the income of which is to be expended by the Engineering Foundation Board for the purpose stated in its charter, "the furtherance of research in science and in engineering, or the advancement in any other manner of the profession of engineering and the good of mankind."

Mr. Towne was an engineer and manufacturer, a Past-President of the American Society of Mechanical Engineers and active in its affairs. For many years he was a friend of Ambrose Swasey, the founder of Engineering Foundation. Like Mr. Swasey, he was a believer in the value of engineering research. This contribution to Engineering Foundation is a notable testimonial by a man of unusually wide and varied interests to the high importance of research to the engineering profession and the industries of our country.

WELDING AND SOLDERING NICKEL

In circular No. 100 Bureau of Standards points out that nickel cannot be smith welded owing to a coating of nickel oxide which is impossible to be fluxed and which prevents a thorough fusion of the two surfaces to be welded. On the other hand, the metal may be satisfactorily welded where a reducing atmosphere may be retained. This may be done by means of the oxy-acetylene torch, metallic arc welding process or by electrical resistance welding.

The latter method is one used in welding nickel wire to iron lead wire in the making of points for spark plugs. The bulletin states that nickel may be soldered and brazed by the ordinary methods and that it should be tinned before soldering, as is done with iron.

ANOTHER SMITH'S INVENTIONS FOLDER

"Liars May Figure But Figures Don't Lie" is the title of a new folder brought out by the Smith's Inventions, Inc., of Minneapolis, Minn.

This folder tells in an interesting way about the Smith's Automatic Acetylene Generator adaptable for use in the welding shop garage or machine shop. These circulars may be had by writing to this company.

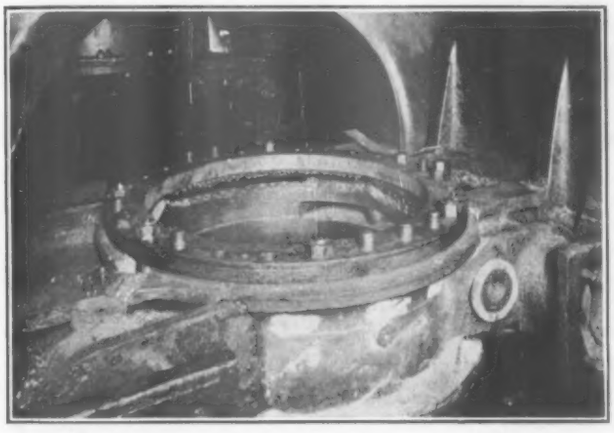
The Electric Arc in the Job Shop

This Process Can Handle a Variety of Commercial Shop Work—The Importance of the Operator and His Training

By Robert Siemer*

TO THE writer it is an interesting reflection that as recently as five years ago electric arc welding was practically unrecognized in commercial welding shops. In the western part of New York State (the section with which the writer is most familiar and in which he has been closely associated with the manufacture and supervision of arc welding on a commercial scale) there was only one welding shop employing the electric arc process in 1919. Today 90% of the commercial welding shops in that section have installed electric arc welding units.

The skepticism and doubt which in the past has seriously handicapped the wide use of this process is vanishing, and welders throughout the country are gradually becoming convinced of its merits. The flexibility of the electric arc process is being constantly demonstrated by the variety of jobs it can handle for the commercial welding shop, and as new jobs and kinks are conquered the doubt and misgivings are removed.



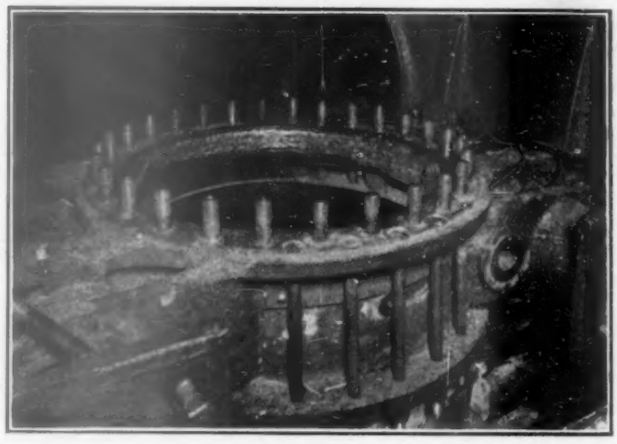
Cylinder broken for entire circumference of 44 inches

The importance of electric arc welding in connection with automotive repair work is its simplicity and speed in getting the job done, as well as the elimination, to a certain extent, of the danger of fire. Further, as no preheating of the metals to be welded is required, no excessive strains are set up in the parent metal and the job can be accomplished in a small amount of time. As we all are aware, customers want service, especially those driving automobiles, therefore the shop equipped with man and machine power to make the best job in the least possible time is the one that will get and hold such business. Automobiles give the electric arc many opportunities to make repairs in an economical way. Broken water jackets, frames, bumpers, housings, brake drum castings, tire carriers, fender brackets, cast iron crank cases, are all ideal electric arc welding propositions, all of which can be successfully welded without dismantling or preheating, provided, of course, that the break can be reached without removal.

The welding of cracked water jackets has been a large item in the writer's experience during the past three winters. The repairs are made with a patented method, being that of the semi-arc using a nickel filler rod. The method employed is to Vee out the crack with a small diamond point chisel, thoroughly clean away any oil, grease or foreign materials from surfaces where welded metal is to be deposited, and apply the semi-arc method of replacing the removed material. This work can be done in any position, and while a knack is requisite in using this method of deposit, it is no trick, but can readily be accomplished after some diligent practice.

This semi-arc method of welding defective cylinder blocks is employed by many foundries in the eastern part of the United States. Two of the largest automobile cylinder foundries in the state of Ohio have found this method admirably suited to their requirements and some days as high as 100 blocks are salvaged by four operators in foundry practice. After welding, the blocks are tested to 80 pounds water pressure with success. It must, of course, be understood that no very large or extensive breaks, such as would be found in a commercial welding shop, are undertaken to be salvaged, but mostly sand holes both in and out of cylinder bore.

The use of the electric arc in the fabrication of steel tanks has made wonderful strides during the past two years, in fact, to such an extent that in the production of low pressure tanks the entire country has turned from riveting to welding, and this has come about as the result of a perfectly natural evolution. Sometime back, we had occasion to erect an open tank on the roof of a brewery for water storage purposes. The tank measurements were 27′0″ to 30′0″ x 61′0″ to 64′0″ x 42″, all of ¼″ plates, approximate weight 14 tons. Plates of suitable widths and lengths were ordered from mill and carted from the freight station to their destination, then as they were hoisted onto the roof, the bottom plates were distributed to their proper permanent places, properly lined up and tack welded, the side plates were then set up and tacked. After the tacking operation had been completed, two operators remained to complete the welding. What a simple operation as compared to the old method of fabricating such a tank with the riveting process; the welding eliminated drawings; templates; punching of holes; reaming of holes; bolting of preparatory to riveting; heating; passing and driving of rivets; the caulking of seams and last but not least, the elimination of the noisy "rat-a-tat-tat" of the air hammer.



Same cylinder after being repaired by the electric arc process

*Allan Manufacturing & Welding Co.

No one in the immediate vicinity knew that a tank was being constructed, and the erection could have been as readily performed in the dead of night without the least bit of noise. This noise elimination is a great advantage and one that will in time be largely considered. For instance, in the steel erection of a large office building, welding can be carried on in place of riveting. The only drawback at present is the human element involved and architects and engineers are not yet prepared to depend upon it; which therefore is a question of the proper schooling of welding operators.

In the field of cast iron welding the repair of a housing of a 30" roll comes to the writer's mind as one of several big jobs which were successfully done. The broken sections, two of them were 21" x 17", the entire casting weighed approximately 24 tons, the breaks were veed out on four sides and in addition to steel studs, four keys were employed in making the repairs. Approximately 2,200 pounds of metal were deposited in the vees. This casting was repaired some three years ago and from last accounts was still in harness. A saving of about $4,000 was created by utilizing the electric arc in this repair.

The repairs to a high pressure cylinder of a 3,500 H. P. blast furnace engine requiring 150 pounds steam pressure is another job which merits mentioning. The diameter of the cylinder was 44", the thickness of the cast iron wall, 2½". The break occurred 10" from the top of the cylinder for its entire circumference, the ring thus formed being broken into four pieces. The operation consisted of welding the four broken pieces into one, then welding the entire circular top piece to the cylinder proper. This operation was performed 55 feet above the engine room floor with similar engines working along side causing considerable vibration. The work required approximately two weeks, employing two operators. The cylinder has now been in commission for over a year working as well as before the break occurred. The saving here in dollars by welding instead of installing a new cylinder was, as may be imagined, very large; not only this, but the speed in making the repairs was indeed a big item and one given the most consideration, as a great deal depended upon the early resumption of the operation of this engine.

The great flexibility of the electric arc method of repair was clearly demonstrated in the welding of eight scores in the bore of an eight-foot diameter cylinder of a low-pressure blast furnace engine. These scores ranged from ⅛" to ¾" in depth by 1" to 3" in width. All of the scores were five feet in length. The metal therein deposited by the electric arc will permit at any time the reboring of the entire cylinder. The cost of this work to the customer did not exceed $225.00.

The management of a very large office building was confronted with a crack 8' 6" long in one of their numerous . . . , elevator casings, putting out of commission, for the time being, a much needed passenger elevator. Here again the electric arc and an experienced operator came to the rescue. The crack was veed out to within ⅛" of its thickness of ¾", properly studded, then welded. Studs, or welded metal, dare not penetrate beyond the thickness of the parent metal, as a packed plunger traveled up and down in the bore of the casing. The pressure requirements were from 150 to 175 pounds of cold water. The casing or cylinder in question was 14" inside diameter. This job was completed 18 months ago and the elevator has been in commission ever since. A wonderful saving in dollars and cents was here created to what extent we do not know, but it must have been large as the removal and replacement of the casing in question would have meant. in this instance, the removal of a portion of a brick wall; masons riggers, erectors, etc. All were swept aside; one man and the flexible electric welding method completed the job.

A similar job as last related, occurred in an elevator casing in another office building some sevently miles from Buffalo. Again the electric arc and a dependable operator came to the rescue. The cylinder referred to was 20" inside diameter, ⅝" material with a crack over 7 feet long. The same successful previous method was employed with excellent results and the customer converted into a booster for electric welding.

In conclusion, it must be recognized that there are limitations in electric arc welding as in everything else, further—that the operator, himself, spells "success" or "failure" for the job. Too often we overlook the great importance of the human element in successful welding. The reader has probably noticed repeated allusion to the "skillful operator" in the foregoing accounts of successful welding jobs. This, in the writer's opinion, is 90% of the success in welding. The filler rod is approximately 7% and the welding unit 3%. Consequently it would seem advisable to devote far more attention to the proper training of welders than is the custom at the present time. Today there are more arc welding units in the field than there are competent operators to man them. The result of this condition is obvious—unsatisfactory work.

To further popularize the arc welding process it will be necessary to eliminate this feature. Customers cannot be expected to accept arc welding if the job is not satisfactory, and the chief cause of dissatisfaction is the inability of the operator to perform the work properly. The writer is a firm advocate for intensive training of welders. What the welding field is in dire need of today are more schools for apprentices, thorough courses of instruction, annual or semi-annual examinations, and graduated operators holding certificates of proficiency. When welding shops can select operators with such credentials and qualifications there shall be considerably less use for rivets.

WELDING RODS, IRON OR STEEL VS WIRE, IRON OR STEEL

The lastest despatch from the Official Classification Committee, dated November 11, 1924, cancels all previous advice and serves as a correction of a news item "Reduction in Freight Rate on Welding Rods," which was printed in the October, 1924, issue of *The Welding Engineer*. It is as follows:

To the Inspection Bureaus:

On account of questions having arisen as to what rating should apply on welding bars and rods and welding wire or wire for welding, the Consolidated Classification Committee has made the following ruling:

1. That if the shipments consist of welding wire or rods of a number of lengths, put up in cartons, each carton being marked "Welding Sticks," "Welding Wire" or "Welding Rods," the ratings for welding rods, per supplement No. 16, page 53, items 13 to 15, will govern.
2. That if the shipments consist of iron or steel wire, which have been coated or covered (not copper dipped) and are advertised as "Welding Rods" or "Welding Wire," the ratings for welding rods will apply.
3. That if the shipments consist of iron or steel wire, plain or copper dipped, and are not advertised or sold as welding rods, nor invoiced as such, they will be rated as iron or steel wire, N. O. I. B. N.

It has been found that in some cases ordinary wire can be used for welding purposes and in such cases, the shipper is entitled to the ordinary wire ratings, regardless of the use made of the wire.

In case in question, these shipments are invoiced as flux coated welding rods, coppered welding rods and bars bright welding rods and various trade names, therefore, the rating for welding rods govern.

The Interstate Commerce Commission in Opinion 1414 said:

"A manufacturer's description of an article to induce its purchase by the public, also describes it for transportation and carriers may accept his description for the purpose of classification and rates."

Eliminating The Oxygen Waste*

French Engineer Expresses Foreign Need for Accurate Regulators and Greater Operating Skill

AMONG the numerous technical papers read at the Eighth International Acetylene and Welding Congress was a Paper entitled, "A Contribution to the Study of the Cutting of Steel by means of the Oxy-Acteylene Flame and a Jet of Oxygen," by M. Piette. This Paper contains so much valuable data that it is the intention of the Congress to publish a special monograph giving the full results. In the meantime the following summary of the principal results will prove of great practical value to an industry which, at the present time, is the principal cutlet for oxygen.

The Paper consists of two distinct parts, the main portion being devoted to giving the results of experimental work and research to determine the most economical method of cutting constructional steel. An analysis of the method of cutting and the results obtained is preceded by an examination as to the reasons for the uneconomical and poor cutting results, by no means uncommon in workshops. The author first of all compares the slow development of the application of cutting to constructional work in France with that of other countries, the United States for example, where the use of cutting machines is extensive and rapidly developing. The principal reasons for poor technical and economic results, in the more backward countries, are then summarized as follows:—

(1) Insufficient knowledge, on the part of the operator, as to the exact nature of the phenomena of cutting.

(2) Insufficient knowledge of the construction and working of the blowpipe.

(3) Difficulty in determining and controlling the correct cutting pressure.

(4) Difficulty, with certain blowpipes, in changing and correctly positioning the interchangeable details of the blowpipe.

The following important passages appear in the paper:—

Excessive Pressure. The use of excessive oxygen pressure by unskilled operators is generally due to one of two causes. The first is erroneous ideas as to the mechanism of cutting. It is commonly believed that cutting results are obtained by the force of the jet of oxygen, and thus the cutting phenomena is considered as belonging to the physical or mechanical order and not to the chemical. It is necessary, in order to displace from the mind of the operator this idea of the mechanical power of the jet of oxygen, to substitute the chemical phenomena idea, that is, the combustion of iron in an atmosphere of oxygen.

The second cause, and one which invariably leads to the use of excessive pressure by beginners, is the use of gauges on the oxygen regulator with a range of working pressure much too high. Gauges graduated to read 300, 350 and 500 pounds per square inch are found on oxygen regulators used, by beginners, for cutting. These graduations are much too high and it is easy to understand that a welder using such a gauge for cutting, with pressures based on similar methods as used for welding, considers he is using average pressures when the pointer reads say 90, 110, or 150 pounds per square inch, because when welding with a gauge graduated up to say 70 pounds per square inch he uses pressures of 20 to 35 pounds per square inch.

It will be shown later that the oxygen pressure required for cutting steel plate about 1 inch in thickness is practically the same as that required for welding the same thickness, and it is very seldom, in the general run of cutting found in workshops, necessary to use an oxygen pressure exceeding 50 to 70 pounds per square inch. Higher pressures than this are necessary for heavy cutting but this is generally done by a cutting machine and the regulators used for this purpose are of special design, capable of delivering large quantities of oxygen fitted with a large diaphragm and considerably heavier than the ordinary type of regulator used in workshops.

The question of the bore of the orifice of the cutting nozzles is next dealt with:—

Bore of Cutting Nozzles.—The second cause of unnecessary expense is to be found in the use of nozzles, through which the cutting oxygen flows, with too large a bore. The use of nozzles with too small a bore is, on the other hand, extremely rare.

Generally, the operator is found to be absolutely ignorant as to the various bores of the nozzles he is using. It follows then that for work of a very diverse character the same blowpipe which, of course, is equipped with a cutting jet suitable for heavy material is unsatisfactory as soon as the operator begins to cut thin sections because the blowpipe in this case is too powerful.

Workmen operating cutting blowpipes dislike the frequent changing of the cutting nozzle because considerable care and adjustment are required when interchanging details. It is necessary to adjust the details so that the extremities of the cutting and heating nozzles are at the seam level and in such a manner that there are no leakages past the joints, one of the causes of backfires in the blowpipe.

From the point of view of the centering of the nozzles and the ease with which nozzles can be changed and regulated, it is satisfactory to note that very great progress has been made during the past two years. Cutting blowpipes have been successfully modified and many of the principal manufacturers have produced blowpipes with important improvements, equipped with cutting nozzles suitable for a wide range of work, and with which the operator can obtain the most economical results.

It is necessary to direct attention to the fact that most workmen do not know or appreciate that the crosssectional area of a circle varies as the square of its diameter. It follows that for the same pressure the supply of oxygen from a nozzle of a certain bore is increased by four times when the bore or diameter is doubled. It is, however, the haphazard increase of cutting pressure which is responsible for the large waste of oxygen. Now that the cutting pressures, when properly chosen, need not exceed, for steel plates ⅜ to 1⅝ ins. thick, 35 to 45 pounds per square inch, and for heavy cutting 55 to 70 pounds per square inch, it will be seen how unsatisfactory and hindering to the extension of the cutting process it is to encounter foremen and supervisors who frequently allow and even recommend pressures greatly in excess of these figures.

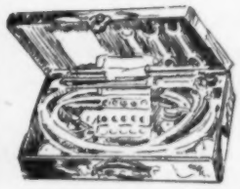
After indicating that the control of the cutting pressure is really the economic pivot of the cutting process, M. Piette foreshadows the use of a pressure indicator attached to the blowpipe and protected in a suitable manner.

Before dealing with this question and before passing to the second part of the Paper the following important points are made:—

(1) *That the greatest possible publicity should be given to the fact that low pressures should be employed for the cutting oxygen, and that tests have shown that the usual cuts made in*

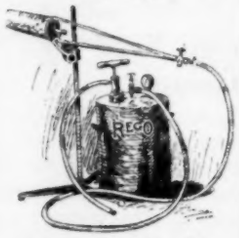
**From a translation M. Piette's paper by Capt. D. Richardson, The Welding Engineer Representative in Great Britain.*

REGO Outfits.



There is a REGO outfit for every type of work, from the fine work of dentists and jewelers to the large welding and cutting jobs encountered in industrial shops. Each outfit is packed individually in a carrying case or carton. Prices are attractively low.

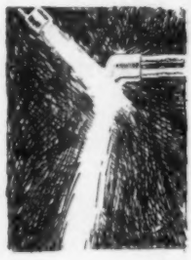
REGO Portable Kerosene Preheaters



REGO Portable Preheaters are quick, clean and economical. Consist of a fuel tank, pump and burner. A few strokes of the pump every half hour keeps them going. Large size develops flame 2½ - foot — small size, a 9-inch flame.

8K—10-gal. tank —each $60.00
11K— 1-gal. tank —each 22.50

REGO Welding Torches DO NOT BACKFIRE



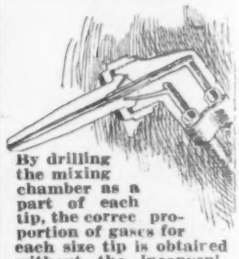
Try this test—Heat a REGO Torch head with another torch flame — Even then there will be no backfire.

REGO Compressed Air Preheaters

Use low grade kerosene and operate on compressed air at 80 to 90 pounds pressure. Quality of flame can be varied from intense heat sufficient to melt cast iron, to soft voluminous flame for preheating.

9K—Complete .. $30.00
10K—(as illustrated) 15.00

REGO Tip Mixing Welding Torches



By drilling the mixing chamber as a part of each tip, the correc proportion of gases for each size tip is obtained without the inconvenience of constantly changing separate mixing chambers. Each torch comes complete with assortment of 5 tips. Prices

L Torch—Length, 22 in..... $37.50
MT Torch—length, 19 in..... 27.50
S Torch — length, 17 in..... 20.00
W Torch—length, 14 in..... 15.00

REGO Cutting Torch

Length, 20 Inches. REGO K cutting torch eliminates the trouble of leakage in the H. P. oxygen valve encountered in most cutting torches. The long H. P. control lever used permits the use of an exceptionally strong valve closing spring which is controlled by a slight touch of the finger. Each tip has its own mixing chamber.

Price—K torch and 5 tips..... $55.00

REGO

WELDING AND CUTTING APPARATUS

IS SOLD BY

Two hundred fifty gas companies, jobbers and service organizations throughout the U. S. Each carries a stock of REGO Apparatus and is equipped to take care of your needs. The Sales Service Representative in your territory will tell you where the nearest stock is located.

REGO TRADE MARK

REGO SALES SERVICE REPRESENTATIVES.

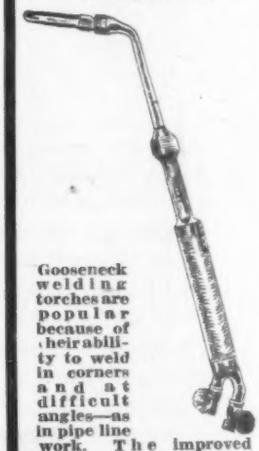
Carter Welding Company of Toronto, Ltd. ..... 165 Adelaide Street, West, Toronto, Ont., Canada
Courtney-Eck Company ..... 441 Douglas Bldg., Los Angeles, Calif.
Courtney-Eck Company ..... 914 First Avenue, South, Seattle, Washington
Courtney-Eck Company ..... Sharon Building, San Francisco, Calif.
Kentucky Oxygen-Hydrogen Co. ..... Logan St. & Goss Ave., Louisville, Ky.
National Welding Equipment Company .. 419 South State Street, Syracuse, N. Y.
St. Paul Welding & Mfg. Co. ..... 174 West Third Street, St. Paul, Minnesota
Southwest Welding Supply Company .. 502 North Harwood Street, Dallas, Texas
Weldox Equipment Company ..... 359 West 52nd Street, New York, N. Y.

MANUFACTURERS

THE BASTIAN-BLESSING COMPANY

246 E. Ontario Street Chicago, Illinois

REGO Gooseneck Welding Torches



Gooseneck welding torches are popular because of their ability to weld in corners and at difficult angles—as in pipe line work. The improved REGO gooseneck mixes the gases AWAY FROM the operator's hand.

Prices

REGO GL Large Welding Torch—with 6, 12 and 24-inch extensions and 10 tips..... $65.00
REGO GM General Welding Torch — with 6 and 12-inch extensions and 9 tips. $40.00
REGO GS Light Welding Torch—15 inches long—5 tips $20.00

REGO Cutting Tips

REGO Cutting Tips are made of copper, selected because of its unusual heat resisting properties. The mixing chamber is drilled as a part of each tip (patented construction)—so that each tip has a mixing chamber which gives just the right proportion of gases for maximum efficiency.

Price, each..... $3.00

Special Tips

Tips for other gases than acetylene, such as hydrogen, pyrogen, butane, etc., as well as special tips for rivet cutting and sheet metal cutting may be had if specified.

Price, each..... $3.00

REGO Single Tank Holder

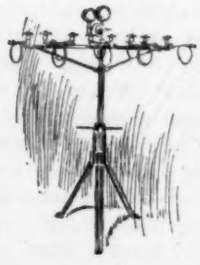
REGO B Single Tank holders hold 200 foot standard oxygen and hydrogen tanks. Convenient for moving tank from place to place when burning carbon, filling balloons, etc.

Price, each..... $4.50

REGO Cutting Torches DO NOT BACKFIRE

When making those long cuts through heavy metal and the reflected heat gets the torch head red hot—then is when you appreciate the advantages of REGO non-flashback cutting torches.

REGO Tank Manifolds



For the large oxygen user. Made of ¾-inch extra heavy brass tubing and bronze fittings. Furnished in either tripod or wall type for any number of cylinders.

Write for quotations.

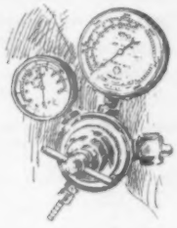
REGO Welding Tips

The accurate drilling of pure copper is a difficult job, but by developing special tip drilling machines, PURE COPPER welding tips have been made practical and are a part of the REGO line.

REGO Loose Diaphragm Regulators

REGO Loose Diaphragm regulators are easy to repair. The diaphragm is clamped in place by the bonnet, which can be readily removed. The regulator can be taken entirely apart without the use of heat. Prices same as for soldered diaphragm type.

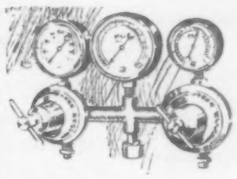
REGO Oxygen and Hydrogen Regulators



REGO double gauge regulators are strongly built, accurate regulators for all kinds of work where constant delivery pressure is essential. Are equipped with safety devices which protect user against accident.

Price—Large size (2⅝" diameter) $28.00
Small size (2" diameter) 18.00

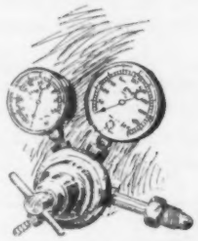
REGO Manifold Regulators



REGO manifold regulators provide for an exceptionally large flow of gas. Are used as master regulators, regulating supply line pressure, and for large welding and cutting jobs where gas requirements are heavy.

Prices quoted on application.

REGO Acetylene Regulators



REGO double gauge acetylene regulators hold a constant pressure right down to the last of the tank. Furnished with P. O. L. welding cylinder inlet as standard—others on specification.

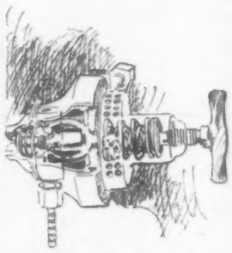
Price — large size (2⅝" diameter) $22.00
Small size (2" diameter) 15.00

REGO Single Gauge Regulators

When it is not necessary that the operator know how much gas there is left in the tank, or how much is used on each job, REGO single gauge regulators will fill the bill. Same in all respects as double gauge regulators, except that they have no H. P. gauge.

Price — Large size (3" diameter)— all gases $16.00
Small size (2" diameter) — all gases 11.00

REGO Regulator Details



REGO regulators are sensitive over a wide range of pressures because they have DOUBLE SPRINGS in the bonnet. At high pressures the heavy, and at low pressures the light spring carries the load. The REGO shut-off action is positive because the GAS PRESSURE ITSELF shuts off the flow.

Adequate safety devices for the protection of the operator include grilled safety bonnet, diaphragm shearing device and non-combustible interior.

There is a REGO Regulator for every sort of work. Write the manufacturer regarding your special problems.

"THE BEST EQUIPPED SHOP GETS THE BUSINESS"

In this day of specialization and competition the welding shop must have the best and most up to date equipment obtainable to remain in the running. If your gas costs run half again as high, and your labor half again as much as your competitor—he is going to get your business.

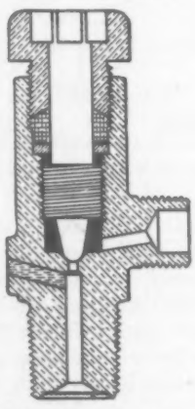
By equipping your shop with REGO you know you have the most up to date and efficient oxy-acetylene apparatus on the market.

THE BEST EQUIPPED SHOP IS THE REGO EQUIPPED SHOP

REGO Acetylene Generators

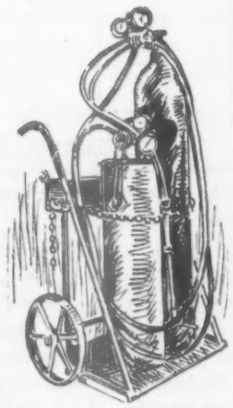
REGO Generators have a 20% over water capacity, which enables them to deliver clean, cool gas at all times, and to stand an overload without danger. Made in 50, 100, 200 and 300-lb. sizes. Prices on application.

REGO No. 733 Acetylene Drum Valve



Made with both ¾" and 1" shank.
Write for quotations.

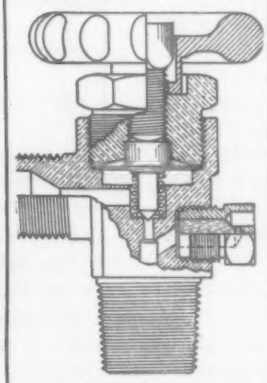
REGO Two Tank Trucks



For moving tanks and apparatus about the shop.

Style A truck, each $16.50

REGO No. 751 Diaphragm Drum Valve



A needle point seat and diaphragm type of drum valve eliminates leaks in seats and around stem.

Write for prices.

REGO Plant Equipment

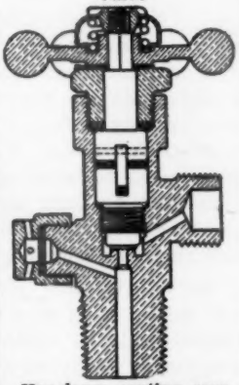
The REGO Line includes charging manifolds, gauges, brass pipe, bronze fittings, etc. for high pressure gas plants.

The Manifolds are made of sections of ¾" brass pipe screwed into bronze fittings. This construction makes it a simple matter to add on extra sections when needed. The pipe and fittings have been tested under 10,000-lb. pressure, providing an ample factor of safety.

The ¾" brass pipe, bronze tees, elbows, crosses are also sold separately for making plant installations.

Prices on Application.

REGO No. 962 Oxygen and Hydrogen Drum Valve



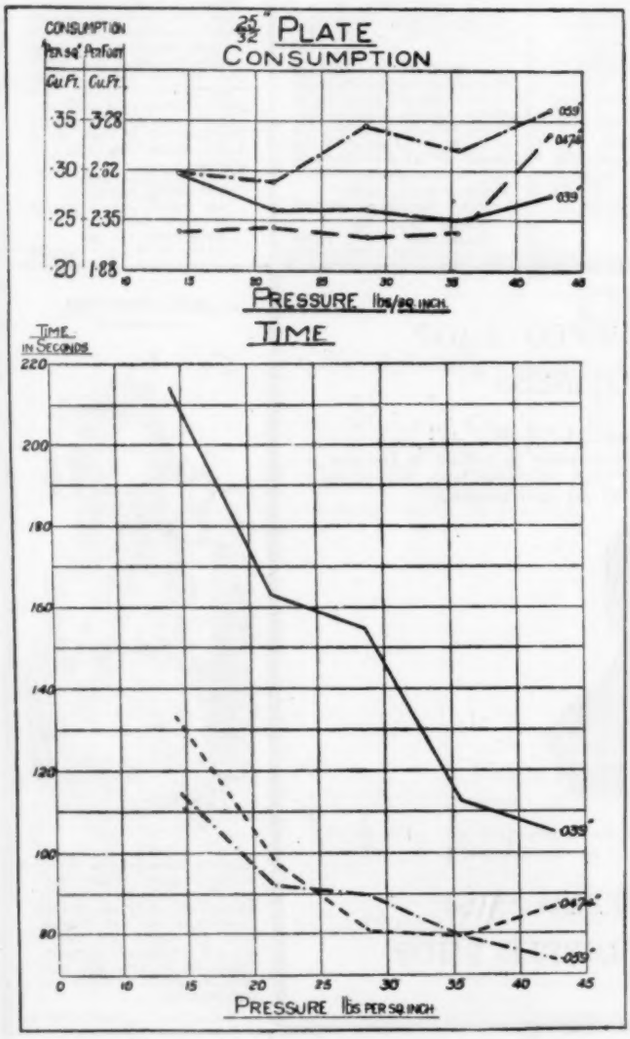
Has large seating area. Easily renewed soft metal seat cannot be damaged by dirt or particles of rust.

Write for prices.

workshops can be obtained with similar pressures as used for welding.

(2) *That all cutting blowpipes should be sold accompanied by an instruction chart showing the construction, description of working, possible causes of failures and bad results, and instructions for cutting metal.*

(3) *That, for the use of careful operators, and for obtaining the best results, and essentially in production works, a specially designed blowpipe should be used which includes a special pressure indicator to show the actual cutting pressure at the nozzle, placed*



in such a position as to be in constant view of the operator and capable of giving satisfactory service.

(4) *That oxygen regulators for cutting should no longer include a working pressure gauge graduated to cover high pressures.*

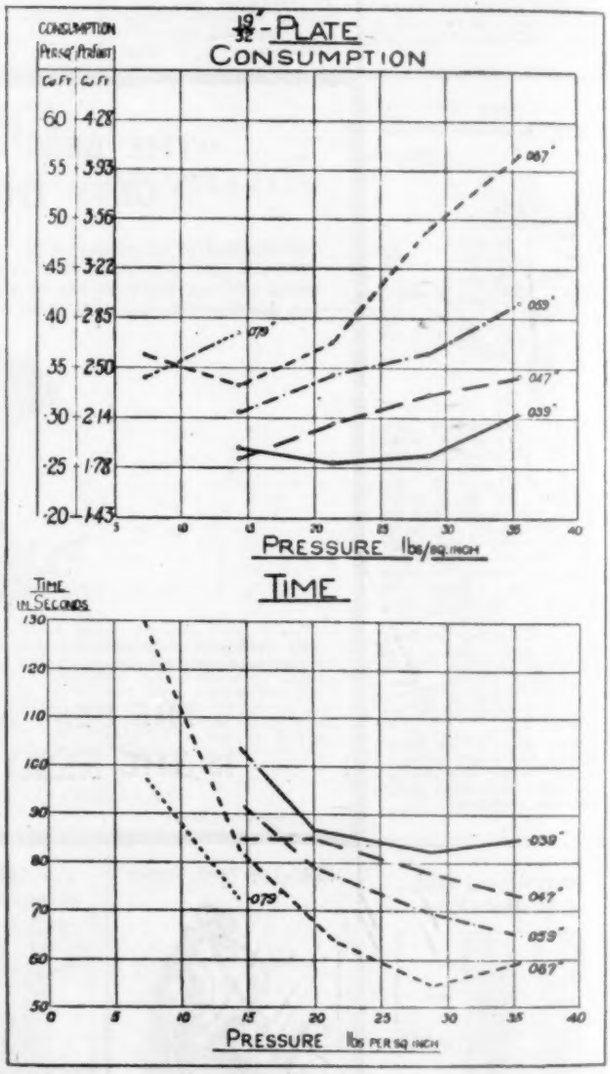
The economic importance of using the correct oxygen pressure for cutting has been shown and the desirability of adapting some form of pressure indicator to the blowpipe was suggested. In this connection the author, M. Piette, says that it is probable that objections will be raised against this suggestion but, before rejecting the idea it should certainly be given a fair industrial test. It might lead to discovering a type of pressure indicator more simple than the ordinary gauge.

A pressure indicator which forms part of the blowpipe itself would possess many advantages. There is, in the first place, the continuous and easy reading of the exact cutting pressure which can be readily controlled by the simple manipulation of the regulating valve of the blowpipe, the oxygen regulator, usually some distance away, being set at the commencement for the maximum pressure likely to be used. Such a device, therefore, would be advantageous when cutting material of varying thicknesses.

With regard to the second solution which consists in replacing the ordinary pressure gauge of the regulator by accurate pressure apparatus, this contains the advantage of simplicity but possesses many disadvantages. In fact, it is well-known that in practice the pressure gauges are continually in danger of being damaged by the careless manipulation of the operator and probably no other part of the equipment gets so rapidly out of order.

There is no doubt whatever that exhaustive tests on these proposed solutions to the problem of the control of cutting pressures should be undertaken. It is possible that with greater accuracy and more light thrown on the unsatisfactory conditions under which the majority of cuts are made, the cutting blowpipe will meet with greater appreciation and be used with more care and attention.

With regard to the principal object of the paper, *i. e.*, the experimental determination of the standard conditions for cutting steel plates of different thicknesses, the author points out that in view of the complexity of the problems involved in demolition



cutting it will be understood that the tests have been carried out on constructional steel plates.

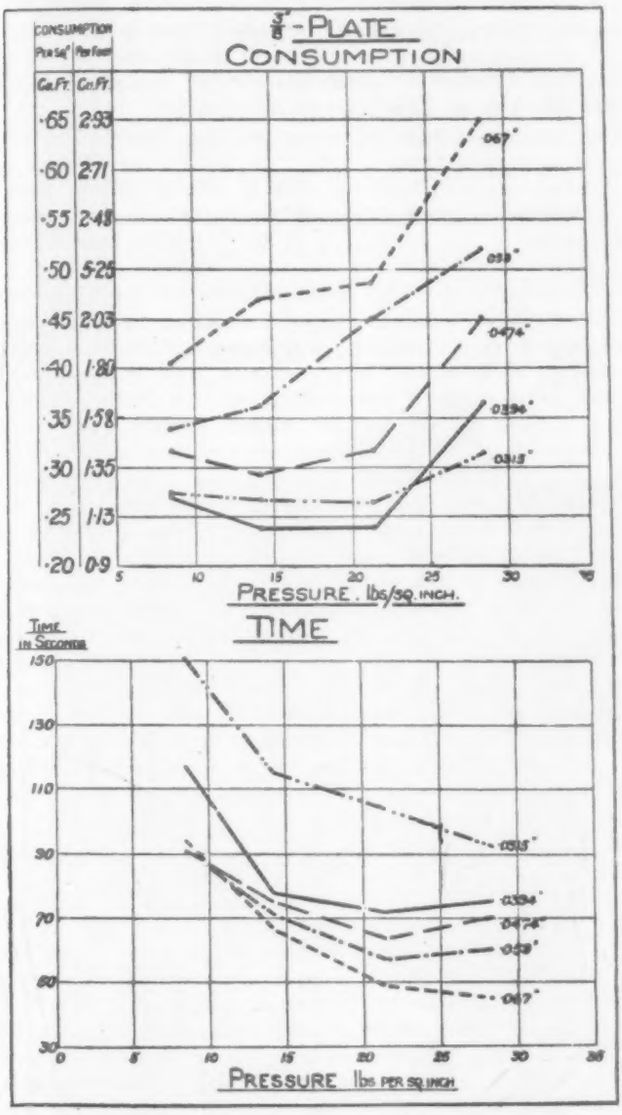
A large number of cuts have been made in which the time and consumption of oxygen have been carefully measured. In order that the researches may serve as a basis for industrial work, the conditions have intentionally been inferior to those obtained in practice and, with a view to meeting the stock criticism that the facilities obtained in a laboratory are better than those met with in ordinary practice, the actual conditions under which the cuts were made are given.

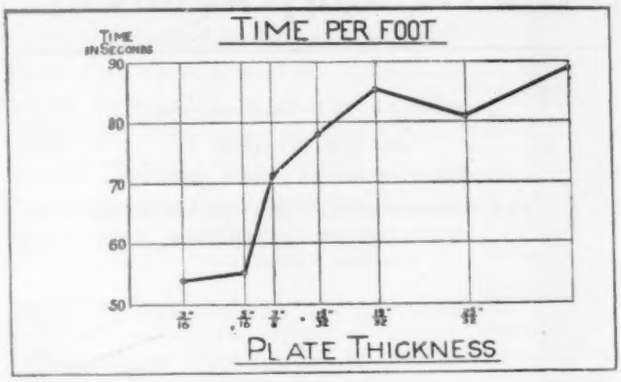
In the first place the oxygen used was 95 per cent purity, the minimum commercial figure and not the average. Secondly, all

the cuts were preceded by passing the heating flame over the surface of the plate along the cutting line and back to the starting point as is the practice on oxidised plates. The time required for this has been about 10 seconds per foot run, but this time has not been included in the actual cutting time, only the gas consumption is included.

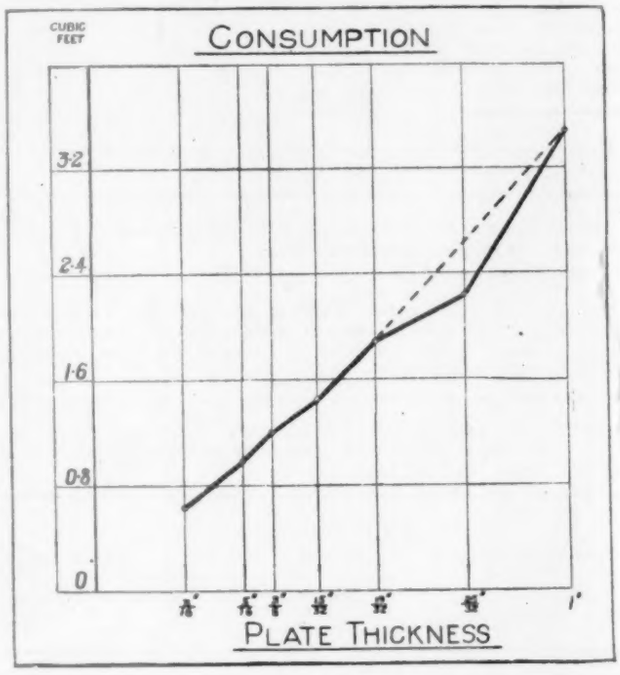
Finally, included in the quantity of oxygen used is that which escapes into the atmosphere during the regulation of the blowpipe. The average time required for this regulation was 10 seconds.

The other conditions under which the cutting tests were carried out had for their object the elimination of important errors. The blowpipes were equipped with an accurate pressure gauge, frequently checked by means of a standard mercury column, and placed in the oxygen cutting conduit as near as possible to the tip of the blowpipe. Thus the actual pressure at the nozzle was under constant control during the complete cutting period for all the tests. These are the figures which appear with the consumption, time, and nozzle orifice figures on the accompanying graphs.





All the cuts have been made, without exception, at a distance from the edge of the plate varying between 1/16 in. and 1⅜ in. Further, the plates were always allowed to cool before commencing a new cut, in order to operate at the surrounding temperature.



The blowpipes were provided with roller guides. The cylinder of oxygen supplying the blowpipe was placed on scales, sensitive

(*Continued on page* 44)

Thickness in inches	Bore of Cutting Nozzle, in inches	Oxygen Pressure at Cutting Nozzle. lbs. per sq. in.	Consumption of Oxygen per square inch, cubic feet.	Consumption of Oxygen per foot run, cubic feet.	Acetylene Consumption per hour. (average) cubic feet.	Time per foot run. Seconds
1/16	0.0236	28	0.54	0.24	12.5	54
1/16	0.0315	28	0.94	0.25	14.0	55
3/8	0.0394	21	1.08	0.24	16.0	71
1/32	0.0474	14	1.40	0.25	16.0	78
1/32	0.0394	28	1.85	0.26	18.0	85
3/32	0.0474	28	2.15	0.23	18.0	81
1	0.0590	36	3.36	0.28	18.0	89

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Welding Can Help Here

Much talk has recently been devoted to welding in the building industry. This is because contractors have been using it more and more, and also, because various companies have been making tests and test buildings to prove that welding is an efficient process to use in this industry. The Fall Meeting of the American Welding Society brought out the thought that welding will soon replace rivets in building construction. Again just recently Ray M. Hudson, Chief Division of Simplified Practice, U. S. Dept. of Commerce, in an address said that, "Tomorrow's profits must come from today's wastes." It would seem that this sort of a statement will bring the value of welding directly home to the building contractor. To quote from Mr. Hudson, "The Hoover Committee on the Elimination of the Waste in Industry made an expert survey of six of our major industries and found that the building industry stood in fourth place with 53 per cent waste. Thirty-four per cent was chargeable to management, and one of the major causes is lack of simplification and standardization in materials, methods, machinery and so on." His remarks give us food for thought. If this standardization of building construction is going through, and of necessity it must, then it is up to the welding engineers of this country to show where and how welding can be used to effect this end, how welding can be used to simplify construction and eliminate many of the present evils which must be stopped. In pipe construction and fitting the saving would be great enough to compensate for the effort necessary. Again in doing away with rivets another step forward will be made. Welding apparatus can effectively make many joints which cause a great waste of time by other processes. Cutting apparatus can be utilized to economically cut pipes, girders and other units, to size on the job, thus eliminating the stocking of too many varieties of the same thing. These are only a few examples of the possibilities of welding. It is up to every one of us to boost all we can and gain the recognition of the building industry in such a way that welding will head the list of curatives for the present ailments.

The Industries

"SINCE the election an important volume of orders has been released, production has been increased and prices have stiffened." This is the gist of an editorial comment on economic conditions in the December bulletin of the National City Bank, New York. "Producers have more orders on their books, are operating on a larger scale, and are trying for better prices, profit margins having been decidedly scanty during the summer depression. Most of the companies showed poor earnings in the third quarter. The expansion of sales is in numerous lines, the railroads leading as consumers, but the building industry, machinery industry and oil industry are contributing. The railroads are still giving large orders for equipment." This is all very good news for the welding industry, for welding plays an all important part in the railroad, building, machinery and oil industries. With the election over and the outcome extremely reassuring the new year should be most prosperous. All indications point that way, and it is up to us in the welding industry to see to it that our industry does its part to build a prosperous nation.

If we all pull together that result will be inevitable and much credit will be reflected upon welding.

Looking Forward

AHEAD of us the new year, 1925, looks even more prosperous than the present year, 1924. This forward trend of industry has already been felt by all of us. And welding has responded in no uncertain manner. It is answering the call of more prosperity and greater achievement. To that same call *The Welding Engineer* is also answering. Its platform for 1925 is one of constructive service to the welding industry. More cannot be said, so we sincerely wish you an exceptionally happy and prosperous New Year.

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Prize Winning Welding Jobs

Welding Which Won First and Second Prizes in Recent Photographic Contest

ON THE first of October, 1924, The Bastian Blessing Company of Chicago announced the opening of a welding photographic contest, open to all users of that company's equipment. Photographs submitted as entries in the contest were to be real action snaps—pictures taken on the scene of the work, while the welding was in progress. As first prize the contestants were offered welding equipment

The job which won first prize

valued at $105.00, or the cash equivalent, and as second prize, equipment valued at $57.50, or the cash equivalent. A number of lesser prizes were also offered to contestants gaining worthy recognition.

The contest closed on November 1, and the winners were picked by a committee of disinterested judges: C. T. Allen, secretary of The Gas Products Association; Stuart Plumley, editor of The Acetylene Journal, and W. W. Brothers, editor of *The Welding Engineer*. The awards were made primarily on the merits of the photographs as working snaps of typical welding jobs, rather than on the merits of the actual work.

From a large number of entries, that of The Balderson Welding Shop, Wamego, Kansas, was awarded first prize, and that of The Ferrofix Brazing Company, 816 First Avenue South, Seattle, Washington, second prize. The prize-winning photographs, together with descriptions of the work are given here.

FIRST PRIZE

Won by The Balderson Welding Shop, Wamego, Kansas.

We were called on the morning of Oct. 19, to do a hurry up welding job for the Sand Company of our city. Loading our portable outfit on our truck, and stopping only long enough to pick up the photographer, we were off to the job. To repair the break the old way would have required several hours shut down, and as the company furnished sand to several large jobs under construction, it would have meant quite a loss of time and money. We welded this job and were back at our shop in fifty-five minutes, twenty minutes being the time of actual welding. Cost of rod and gases did not exceed $1.00. Our charge was $5.00.

(Signed) N. C. Balderson.

SECOND PRIZE

Won by The Ferrofix Brazing Company, Seattle, Wash.

A very successful cutting and welding job was completed on a cast steel cable drum for a logging donkey engine on Oct. 13. The weight of this job was 3,800 pounds. The diameter of the drum was 38 inches, and it was 22 inches wide.

Cost of a new drum	$650.00
Our charge for welding	288.80
Saving for the customer	$361.20

The actual cost of welding was as follows:

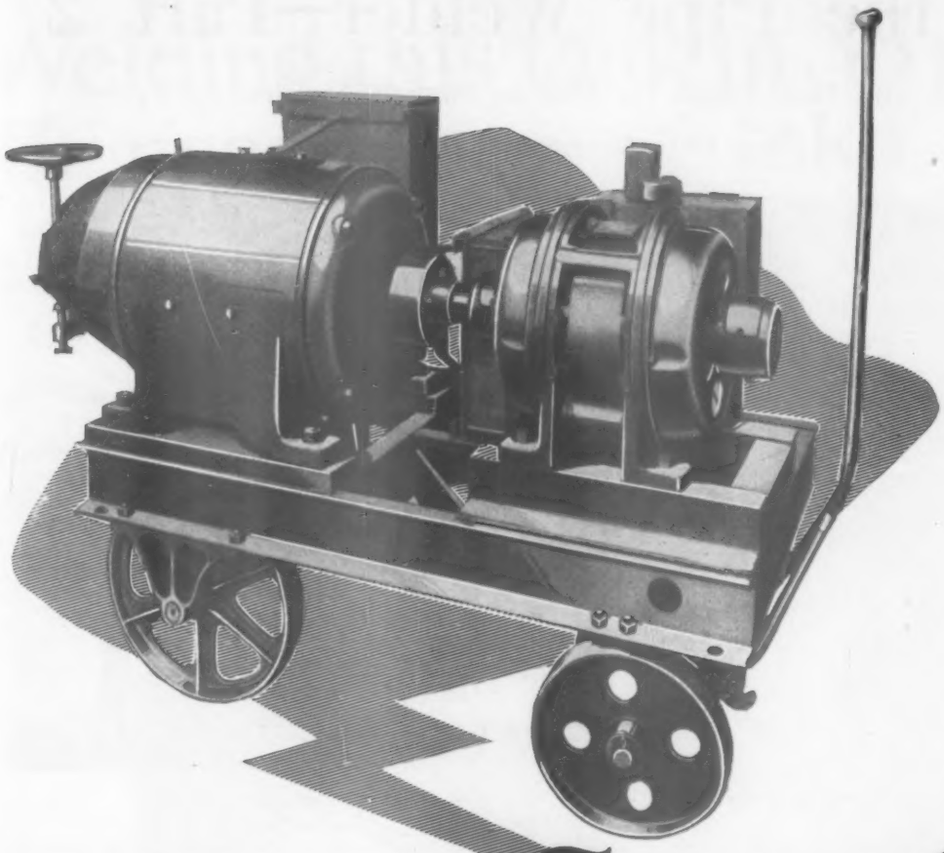
Labor—99 hours	$ 99.00
Oxygen gas	12.00
Acetylene	14.00
Welding rods	5.60

Second prize—There was a nasty break here before being welded

Asbestos	3.00
Fire brick	2.80
City Gas (preheating)	8.00
Total cost of welding	$144.40

Subtracting the cost of the welding from the charge made leaves a profit of 50 per cent, or $144.40, earned by the welding company. Welding was the only means of restoring this drum to its former usefulness.

(Signed) Ferrofix Brazing Company.



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—voltage can be adjusted to suit work.

—any value of welding current between 75 and 300 amperes.

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Helping the Pipe Welder—Part 2*

Patterns and Dimensions for Making Swaged Nipples —Flange Offsets—Special Jigs and Templates

A SWAGED nipple, or reducing nipple is made by cutting out "V" shaped pieces around the circumference of a stub nipple (a nipple with only one end threaded) at the stub end. (Fig. 11-A). After these triangular pieces have been cut as shown,

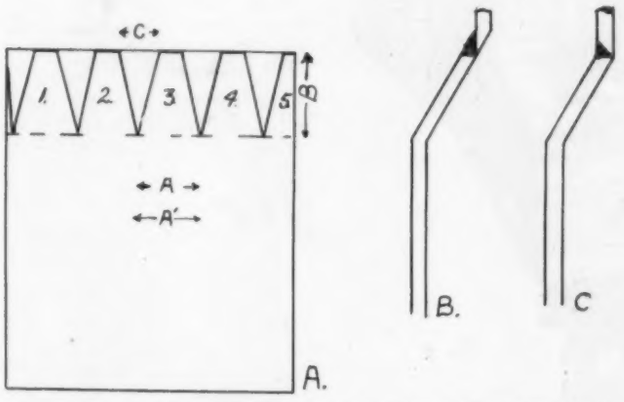


Fig. 11—Procedure in laying out and welding a swaged nipple

the prongs (1, 2, 3, etc.) are heated and knocked in until their sides touch. They are then welded together along the lines of contact. The outside diameter of the small nipple on the top will be the inside diameter of the large nipple. The small nipple is beveled inside and then welded to the large one.

Fig. 12—Some bull tips and swaged nipples

In the matter of welding this small nipple to the larger one the method shown in C. Fig 11 has been superseded by that shown in B. This is because in the latter case the throat is smoother on the inside and it affords a 90 degree "V" in which to weld.

Figure 13 shows the jig used for beveling nipples. The torch, which is of the ordinary straight shank type, is adjustable to any angle, while the stand holding the nipple revolves. This jig enables the nipples to be beveled on the inside or outside, or to be cut off horizontally.

Patterns for the triangular cuts can be made of rectangular 28 gauge sheets to be wrapped around the pipe. These patterns are shown in Fig. 14.

Care must be exercised in having enough stock above and below the triangle so that the pattern will not kink. The accompanying chart gives dimensions on patterns for standard swage nipples.

Offsets constructed between flanges whose faces are parallel are made simply by using two welded ells. Offsets whose flange faces are not parallel are made with either boiler plate flanges or with regular screwed flanges, using an adjustable template and an adjustable offset jig.

In the first method illustrated, (figure 15), plate flanges of

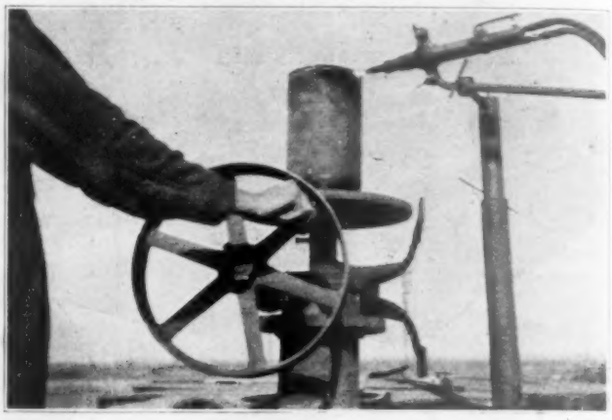


Fig. 13—Jig used for beveling nipples

suitable thickness are bolted to the flanges to be connected. A piece of pipe is cut roughly so that it just enters the flange, to which it is then tacked. The pipe with its flanges is then taken off and welded inside and outside each flange. If it is not permissible to tack in place, a line is marked around the pipe next to each flange. Center punch marks are then put on each offset flange exactly opposite to similar punch marks on the stationary flanges. This makes it possible to take the parts of the offset to the shop, weld them up, and replace them exactly as they were originally set up.

Figure 16 shows how an offset is made using standard screwed flanges. A flanged stub nipple "A" is bolted in place. Cut a wedged shaped piece out of it, bend it down until it

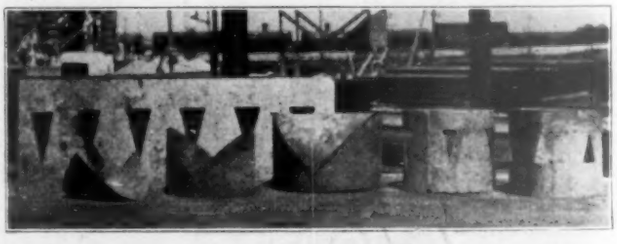


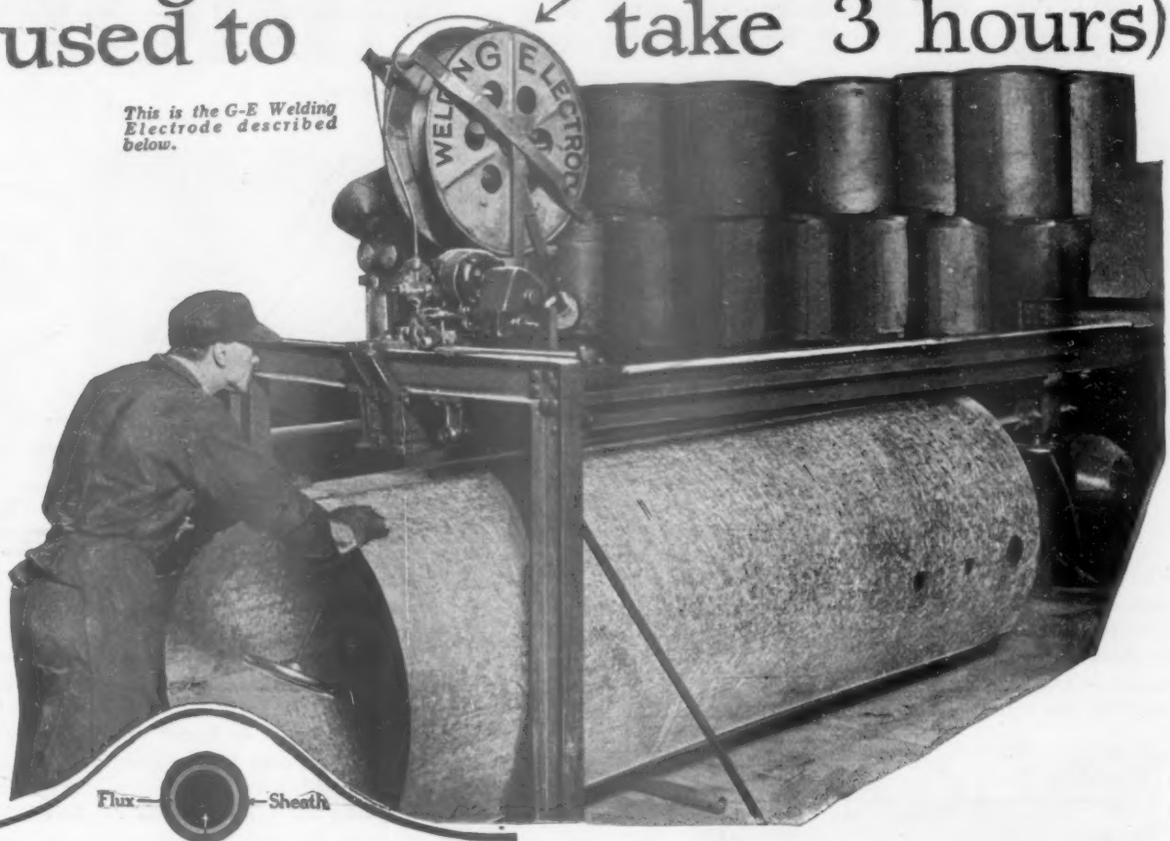
Fig. 14—Patterns of triangular cuts for making swaged nipples

crosses the line of the other flanged end and cut off roughly on that line. Bolt a flanged stub at "B," just too short to touch pipe "A." With one hermaphrodite calliper leg on stub end of "B," scribe a line around "A" as shown. This line will be parallel with the "B" flange. Cut "A" on the scribed line. Substitute for "B" a flanged stub nipple just long enough to reach this cut, and then weld.

In the event that it is not possible to weld in place, as often happens in an oil refinery, the offset may be constructed in the shop in exactly the same way as in the field—in between two flanges X and Y, set up exactly at the same angles which they have in the field. A jig shown in Figs. 17 and 18 is used. This is adjusted to an angle about both horizontal and vertical axes, and is adjustable for length by means of sliding I beams and clamps. Any size flange may be fitted

Continued from November Issue, The Welding Engineer.

Welding this tank in 35 minutes (It used to take 3 hours)



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This booklet (Y-2019) tells all about G-E Welding Electrode. Ask nearest special distributor for a copy.

Welding a galvanized iron tank like this used to take three hours. Electric welding with the G-E Automatic welder and

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does the job in 35 minutes.

The unusual characteristics of G-E Welding Electrode make possible the successful welding of galvanized iron by the arc welding method.

If you fabricate galvanized iron products, joining parts by any other process than arc welding, let us prove to you that we can increase your output, improve your product and save you money. Get in touch with the nearest special distributor.

The core of G-E Welding Electrode is surrounded by a flux, and both enclosed in a metallic sheath.

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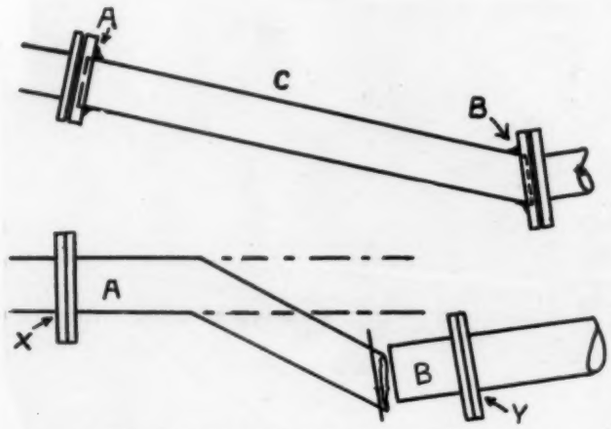
on a short stub nipple with two slots cut in it. A strap and bolt fastening the flange stub to the angle plate enable one to get the flange bolt holes in any position desired.

In order to set the jig so that the position of the flanges in the field is exactly duplicated, an *adjustable template* is used, This is set in the field in the place occupied by the offset, and



Figs. 15 and 16—Offsets for flange welding

after securing the proper adjustment it is transferred to the shop. Let us suppose a rough measurement which shows the offset to be 6 feet 8 inches face to face. The turn buckle is adjusted so that it has 3 inches to go either way and then enough is either spliced in or cut out of the 1 inch pipe to make the template 6 feet 8 inches long. The template flanges

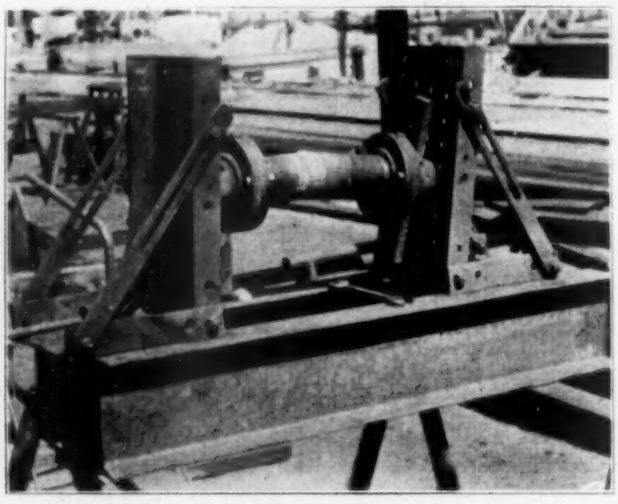


Fig. 17—The offset jig

are then bolted to the pipe flanges on the job, universal joints are locked, the turn buckle is adjusted, and the template is taken to the shop where the jig is set to fit it exactly. It is to be noted that flanges of any size can be quickly fitted to both jig and template for the purpose of constructing an offset of any size pipe. Template flanges are of ½ inch plate tapped in the center for 1 inch pipe and screwed on a bushing connected rigidly to the universal joint.

Perhaps a description of standardization of welding and laying out as followed in an oil refinery will be of value to weld-

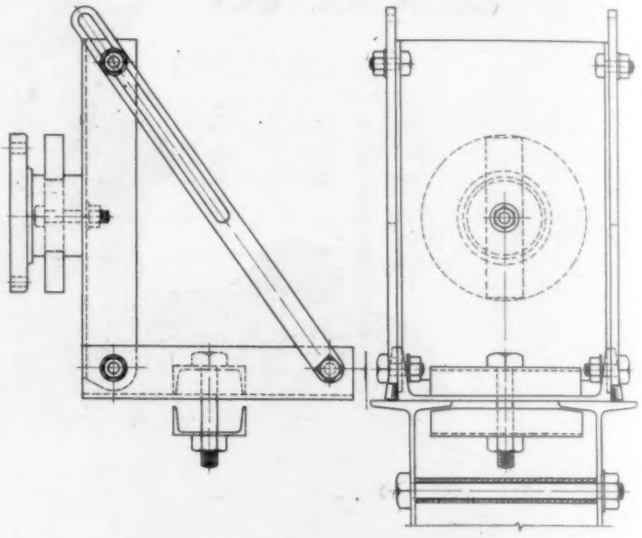


Fig. 18—Working drawing of the offset jig

ers in other fields, and a word about it may not be amiss here. In laying out, a complete set of patterns is used for swage nipples, bull plugs and for cutting other size pipe to intersect each and every size of equal or larger diameter. These are made of galvanized sheet iron unless there is little chance of the pattern being used more than once. Furthermore, every welder, excepting those temporarily employed, is expected to be able to make his own patterns and to lay out and set up all jobs.

Cutting and welding angle and channel frames from blue prints may appear simple, but considerable practice is necessary to knowing how much is to be allowed for stretch and shrinkage in bending and welding corners. Naturally a welder accustomed to this work can lay it out with vastly more economy than can a mechanic who is trained in setting up machine work or riveted structures.

In cutting with a gas torch close supervision is as necessary as in welding, for several reasons. In the first place the operator is less experienced and in the second place a good cutter can do two or three times as much as a new man, and with a smaller oxygen percentage per unit of area cut. Thirdly, pressures are higher and leaks are therefore much more costly. Fourth, tips and torches are more complicated and need more care than welding equipment.

Absolutely apart from any outside data it has been found that a good cutter uses about 3/10 cubic feet of oxygen per square inch of steel cut. If he uses less, it cuts down his speed too much. It might be added here that in making pipe cuts for elbows, etc., it is better, whenever possible, to use the power hack saw than to use the cutting torch. In practice

Chart of Dimensions for Standard Swage Nipples

	12″ x 10″	12″ x 8″	12″ x 6″	12″ x 4″	10″ x 8″	10″ x 6″	10″ x 4″	10″ x 3″	8″ x 6″	8″ x 4″	8″ x 3″	8″ x 2″	6″ x 4″	6″ x 3″	6″ x 2″	6″ x 1½″	4″ x 2½″	4″ x 2″	4″ x 1½″
A	4 3/8	4 3/8	4 3/8	4 3/8	4 1/8	4 1/8	4 1/8	4 1/8	4 5/16	4 5/16	4 5/16	4 5/16	3 5/16	3 5/16	3 5/16	3 5/16	2 1/4	2 1/4	2 1/4
A¹	4 7/16	4 7/16	4 7/16	4 7/16	4 3/32	4 3/32	4 3/32	4 3/32	4 1/2	4 1/2	4 1/2	4 1/2	3 13/32	3 13/32	3 13/32	3 15/32	2 3/8	2 3/8	2 3/8
B	2	4 1/8	6 1/8	8 1/4	2 1/8	4 1/8	6 1/4	7 1/4	2	4 1/8	5 1/8	6 1/4	2 1/8	3 1/8	4 1/4	4 3/4	1 5/8	2 1/8	2 5/8
C	½	1 1/16	1 7/8	2 5/8	½	1/32	2 1/16	2 1/16	¾	1 1/8	2 3/8	2 15/16	¾	1 5/16	1 7/8	2 1/8	1/32	7	1 1/8
	*				*				*								*		

A—Measurement as spaced off with dividers. A¹—Tape measurement on circumference. *—Best to swage these in hot with a hammer.

TOBIN BRONZE

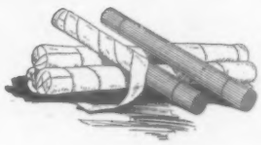
REGISTERED U.S. PAT. OFF.

Welding Rods

TOBIN Bronze Welding Rods—an exclusive Anaconda product—are universally recognized as the most satisfactory non-ferrous rods for Electric and Oxy-Acetylene welding.

Tobin Bronze flows freely at welding temperatures, making joints that are easily machined. Because of its uniform composition and high tensile strength, Tobin Bronze is unexcelled for brazing malleable and cast iron, rebuilding gears and repairing cracked cylinder heads, wheel rims, spokes, housings and all kinds of iron and steel castings.

Anaconda Welding Rods are furnished in diameters of 1/8", 3/16", 1/4", 5/16" and 3/8", in the usual three-foot lengths, special lengths and coils.



Anaconda Welding Rods For Special Purposes Include

Tobin Bronze
Manganese Bronze
Phosphor Bronze
Deoxidized Copper
Naval Brass
Muntz Metal

If you cannot obtain Anaconda Welding Rods from your regular source of supply, correspond with the nearest office listed below.

THE AMERICAN BRASS COMPANY

GENERAL OFFICES: WATERBURY, CONNECTICUT

New York, Chicago
Boston, Philadelphia, Providence
Pittsburgh, Cleveland, Detroit
Cincinnati, St. Louis, San Francisco

ANACONDA
from mine to consumer

Mills and Factories:
Ansonia, Conn., Torrington, Conn.
Waterbury, Conn., Buffalo, N. Y.
Hastings-on-Hudson, N.Y., Kenosha, Wis.

In Canada: ANACONDA AMERICAN BRASS LIMITED, NEW TORONTO, ONTARIO

when using acetylene in portable cylinders it has been found that the cost in cents of oxygen, acetylene and rods is very close to oxygen pressure differences in pounds divided by two. For instance, a job started with 1200 lbs. in a 220 foot oxygen cylinder and finished with 500 lbs. left, shows a cost for gas

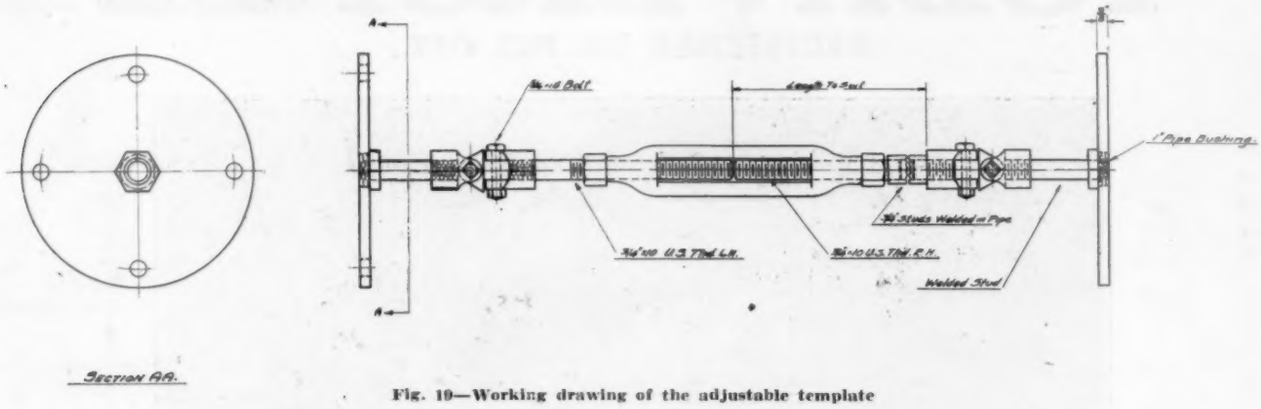


Fig. 19—Working drawing of the adjustable template

and rods very close to $\frac{1200-500}{2}$ =$3.50. To get gas cost in cutting the difference is divided by four instead of two. This takes into consideration the fact that acetylene cylinders can be used for cutting when they are too low in pressure for heavy welding.

Form 2704—1M-1-16-24

NAME ..... No. ..... Date .....

Shop Order	DESCRIPTION OF JOB		Time	Oxy.	Acet.	Rod	Cost
		S					
		F					
		S					
		F					
		S					
		F					
		S					
		F					
		S					
Unavoidable Delay		F					

Reasons:—

Fig. 20—The pipe welder's data card

Filling out data cards as shown in Fig. ? may seem to most welders a lot of trouble, but when put in practice it soon becomes an automatic operation and instills in him more interest in his work. It also furnishes the foreman with checks on his men and material, that is of especial benefit in enabling him to estimate costs of jobs completed and to come.

LABORATORY MANUAL OF MACHINE SHOP PRACTICE

Laboratory Manual of Machine Shop Practice, by Jerry H. Service and Geo. E. Frease; and D. Van Nordstrand Co., New York, 106 p.p.

This manual consists of 35 practical jobs ranging from simple and fundamental problems of laying out, drilling and tapping, filing, and measurements, to lathe work and special equipment work. Mr. Service is the Dean of the Trade and Engineering Schools at the Youngstown Institute of Technology at which institution Mr. Frease is the instructor in machine shop practice. All jobs and accessories contained in the manual are supplemented with minute instructions and working drawings.

STRONGEST WELDED RAIL JOINT SOUGHT

The Bureau of Standards is seeking to determine which type of welded rail joint will last the longest under the impact of street car traffic. Specimens of every type in common use are being subjected to very rough treatment in order to determine their relative durability.

The specimen under test consists of two short lengths of rail fastened together with a joint of the type to be studied. This specimen is mounted on two supports which in turn rest upon a heavy spring supported anvil. A power hammer weighing 400 lb. strikes a blow on the joint once a second, being driven by an electric motor and cam shaft. The succession of heavy blows on the joint produces an effect similar to that from the wheels of cars running along the track and the number of blows required to break the joint indicates its relative strength. The test is a noisy one, even worse than the noise due to flat-wheeled cars or cupped rails.

This test, which forms a part of a thorough investigation of rail joints, is being carried out in cooperation with the welded rail commission of the American Bureau of Welding and the American Electric Railway Association. Four common types of welded joints are being investigated: The fish plate weld, in which the ends of the rails and a pair of fish plates attached to their sides are welded together with an electric arc; the thermit weld; the butt weld, and the cast iron weld. Of these four, the fish plate weld is most used. The butt weld can be used only in new track, as it requires the ends of the rails to be pressed together and melted with an electric current. The thermit weld is used to a certain extent and consists in pouring molten metal into the joint, the steel being melted by the thermit process.

HARRIS CALORIFIC CATALOGUE

The Harris Calorific Company, Cleveland, Ohio, has recently issued "High Temperature Gas Apparatus." This catalogue is handsomely illustrated, and in addition to listing and describing the company's complete line of torches, regulators, guages, and welding accessories, gives tables and data on the treatment of metals which should prove a handy aid to any welder.

REGO CATALOGUE

The Bastain-Blessing Company, 240 East Ontario Street, Chicago, has just received Catalogue No. 32 from the press. This little booklet, of such size as to make it easily enclosable as a stuffer with an ordinary letter, contains photographs and detailed descriptions of the entire Rego line of welding and cutting equipment. In addition to this there are some elementary instructions for the proper manipulation of the various implements. The manufacturers state that copies will be gladly sent to interested parties on request.

WELD IT *Electrically*

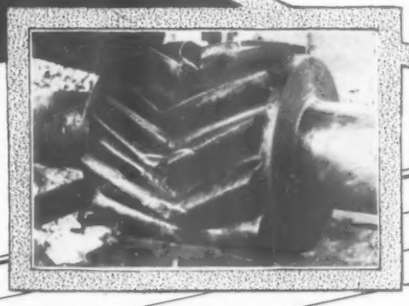
As a time and money saver, arc welding is indispensable. It is not only valuable in production work—but in repair work as well. The saving on a single repair job has been known to more than cover the cost of the set.

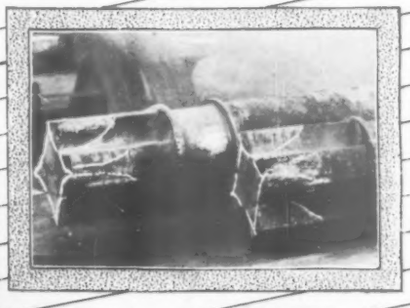
Arc welding may be used in the building up and the joining of all steel, cast iron, copper, brass and bronze parts, such as building up worn spindles and worn faces of jaw clutches for shears, plugging holes in castings, construction of pipe lines structural framework and similar applications.

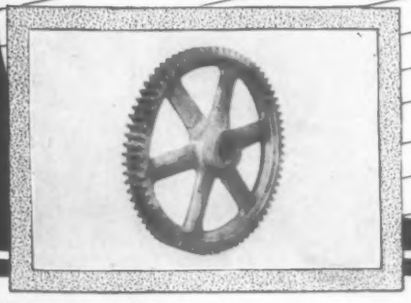
The figures below are actual savings obtained by arc welding.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of
the United States and Foreign Countries

W
WESTINGHOUSE
ELECTRIC





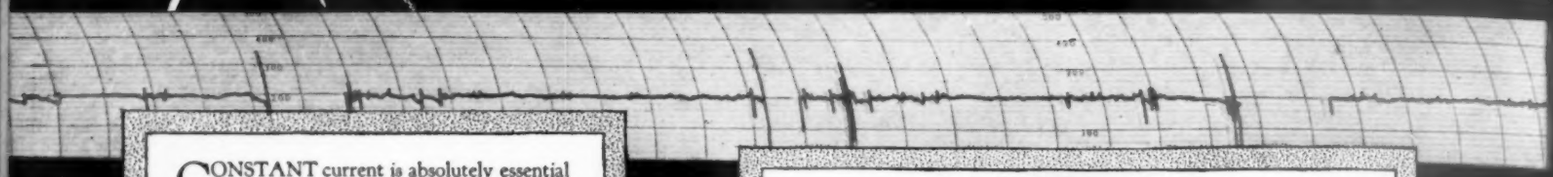


Record of Savings by Arc Welding

Cost of new pinion for 26 - inch mill	$240 00	
Cost of welding	5 00	
	$235 00	
Saving		
Cost of new spindle	$500 00	
Cost of welding	7 50	
	$492 50	
Saving		
Cost of new gear	$15 00	
Cost of repairing	2 00	
	$13 00	
Saving		

Westinghouse

WELD IT *with* THE IMPROVED Westinghouse ARC WELDER



CONSTANT current is absolutely essential to good welding. This chart, taken during actual operation, by a user of a Westinghouse Arc Welder, strikingly illustrates this characteristic.

THE improved 200-ampere Westinghouse arc welder has a wide range of current adjustment—60 to 300 amperes—and will, therefore, *do any welding job that may be required of it.*

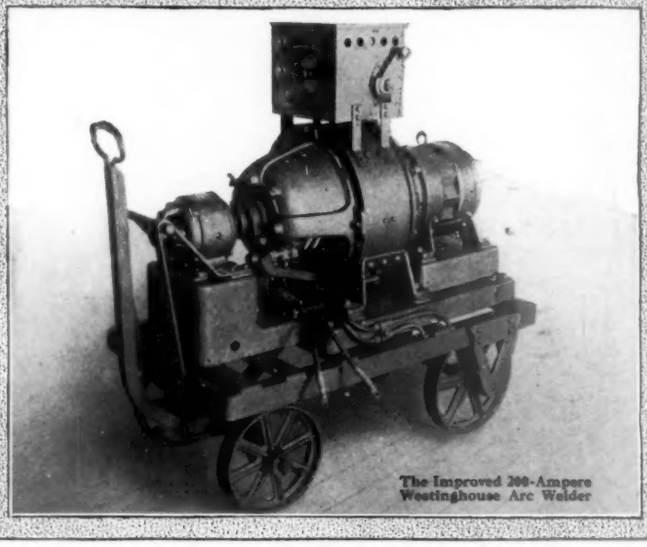
The outstanding feature of this machine is its ideal current characteristic—proved by impartial test to be of superior merit. This important characteristic means:

Good fusion and a homogeneous weld
Ease of striking and maintaining an arc

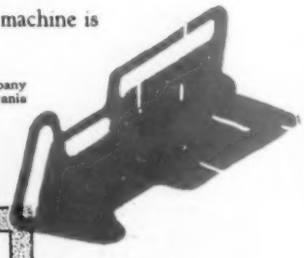
In other words, this welder is *easy to operate,* only one adjustment is necessary, and it will make a *perfect weld.*

The machine is so constructed mechanically that the entire equipment lies within the outline of the truck. This prevents injury to the machine while being moved from one job to another.

Both mechanically and electrically this machine is unequalled.



The Improved 200-Ampere Westinghouse Arc Welder



Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of the United States & Foreign Countries

Send for a Copy of the Arc Welding Text Book

This publication contains 64 pages full of valuable information, and 167 illustrations of arc welding applications. It has for years been recognized as *the* authority on welding, because it explains in an understandable way what arc welding can do, and how it can be profitably used. Actual cost information, research data, technical discussions of welding and cutting, and brief descriptions of Westinghouse arc welding equipment, may be found in this publication. This book will be of help to you. Send for it today without obligation.

ARC WELDING DEPARTMENT
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
EAST PITTSBURGH, PA.

Please send me a copy of your publication—Arc Welding and Cutting.

NAME_____

COMPANY_____

ADDRESS_____

Westinghouse

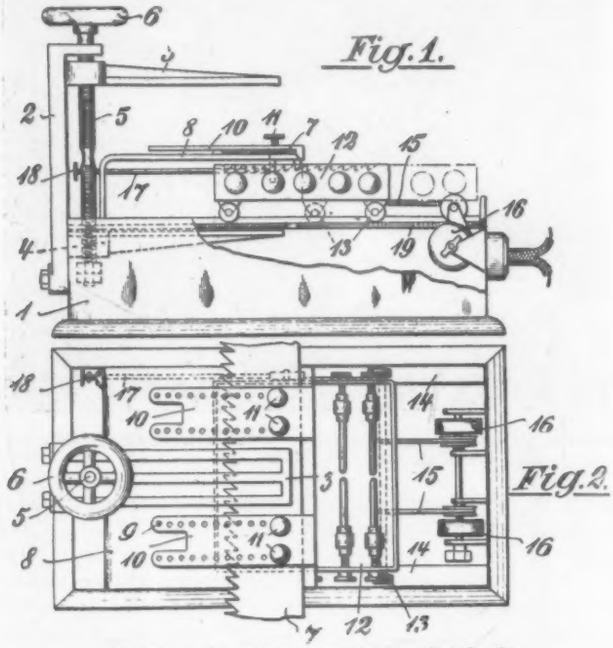
Electric Welding In Manufacture

Automatic Appliances Used in Welding Saw Blades—Auto Rims and Doors—Arc Welding Travel Carriage

IN RECENT months a notable number of electrical welding appliances have made their appearance in the field. These are distributed over a variety of operations in metal fabrication, and represent great advance in the manufacture of articles which must be turned out in large lots. The valuable contribution of welding to large scale production may be comprehended and appreciated by examining a few of these appliances.

Electric Welding Of Saw Blades

Various devices have been designed and patented for welding saw blades by the electric process, but present certain disadvantages which prevent their extensive use. These devices are generally designed for dealing with definite widths of blades so



Apparatus for welding saw blades electrically

that wider blades cannot be joined at all, or only very imperfectly, owing to the irregular heating of the material.

An invention by K. Hauser, of Stuttgart, Germany, relates to a machine which is specially designed for welding saw blades of various widths and which is distinguished by its simple construction and operation, and by the economy in time and labor. According to the invention the carbons are adjustably mounted on a movable carriage, so that the carbons can be adjusted in accordance with the width of the blade. One or several pairs of carbons may be arranged on one carriage, and it is possible to mechanically switch in as many pairs of carbons as are required for the actual width of saw blade. The carriage which supports the carbons is arranged between two jaws designed to clamp the blade after it has been heated. The carriage has rollers running upon rails and is driven by spring mechanism which, after a locking device has been released, moves the carriage out of range of the jaws and causes it to return to its initial position.

A further characteristic feature is the manner in which the carbons are mounted. Apparatus of similar type and known construction possess the disadvantage that if the two carbons are moved to produce the arc a considerable quantity of current is lost and at time short-circuits are produced. In order to avoid these inconveniences one of the carbons is mounted movable in an axial direction together with the spindle for operating it, and the carbon is further controlled axially by a spring in such a manner that the two carbons are always held a convenient distance apart. The carbons can be moved towards each other by depressing the knob of the movable spindle, but they at once move away from each other so that they are only in intimate contact for a moment and the loss of current is quiet negligible.

Fig. 1 shows an elevation, partly in section, of one form of machine and Fig. 2 is a plan.

The machine consists of a frame 1 in which a separate frame 2 is arranged for pressing the jaws 3 and 4, which by means of a screw spindle 5 can be moved towards one another. This spindle is turned by means of a hand wheel 6. The part of the saw blade 7 which is to be welded is placed upon the table 8 and secured in position by flaps 10 having a number of screwed holes 9. The table has an opening for the jaws and under this opening the carriage 12 for the carbons in pairs is arranged; the carriage running with rollers 13 on rails 14. The carriage is connected with the spring mechanism 16 designed to bring it into the position of rest indicated by chain-dotted lines. In the working position the carriage is locked by a pawl 17 arranged to be released by a button.

Automatic Rim Welder

An automatic rim welder, especially suited to the welding of automobile rims, has recently been put on the market by the Thomson Electric Manufacturing Co., Lynn, Mass. This

Automatic rim welder

is called the No. 45 Automatic Rim Welder and has a comparatively large transformer, 150 K. V. A. It can be furnished for use on any ordinary A. C. commercial current line.

The cycle of operation of this machine is as follows: The operator places the rim into the clamp, presses his foot on a

pedal which opens an air valve closing both sides of the clamp and at the same time starts the operation of welding. The welder flashes off a predetermined amount, cuts out the current, makes a final push up and stops. The operator pushes the pedal again and the clamps open, loosening the rim and the platen returns to the starting position.

The operation of the machine may be modified to meet different types of welding. Two pedals may be used, one for closing each side of the clamp and one as a lever which is controlled by hand (the movement of which is approximately one inch) for actually starting the operation of welding. With this arrangement of the machine the operator is able to inspect the clamping of each end of the rim during or after clamping, and also has time to move away from the direct line of flash before he starts the actual welding operation. In this case, as in the first, the clamps are released and the platen returns to its starting position through another stroke of the foot pedal.

This machine is designed for use on either flat, round or irregular shaped stock. Special attention has been given to the preventing of particles thrown off from the work getting into the moving parts. This may be seen in the accompanying illustration. The welder and oil gear are mounted on a special base, providing very rigid connections between the two.

It its claimed that the time of current flow on the ordinary rim is two seconds and that an operator can normally turn out 600 ordinary sized rims per hour.

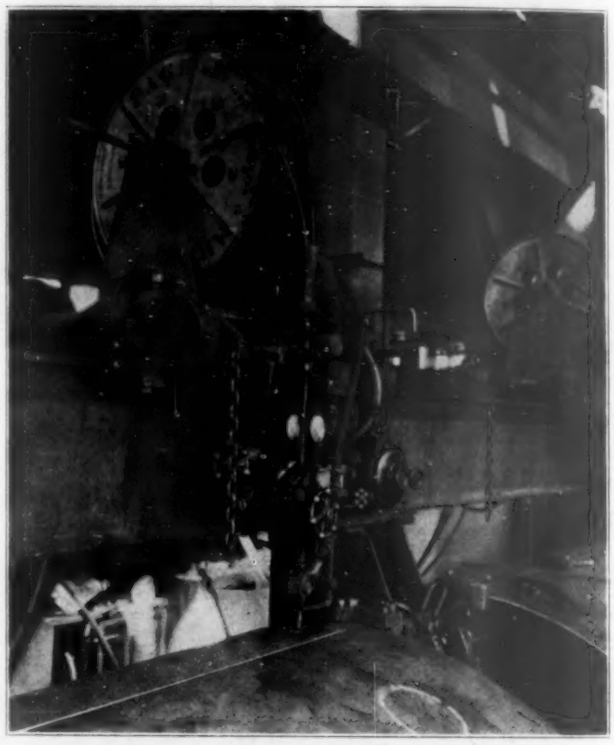
Automatic Arc Welding Travel Carriage

For the purpose of simplifying the welding process in production work where similar welds are made repeatedly on similar articles, a travel carriage has been developed for the

New automatic arc welding travel carriage

automatic arc welding of straight seams. This carriage is a self-contained unit made by the General Electric Company. It consists of an automatic welding head, necessary control, travel motor and wire reel support, all mounted on a suitable framework and provided with wheels for rolling along a track. The welding head and control are mounted on the apron of the carriage and feed the electrode wire from a reel to the arc. This reel is carried by supports attached to the carriage frame.

In operation, the travel carriage is so controlled electrically by means of push buttons that, once the work is set up ready for welding, the operator may throw the system to automatic position, thus confining the control of both welding head and travel motor to one push button. Control of the welding head and travel motor is so interlocked that, when the starting button is



Another view of the travel carriage with work mounted ready for welding

pushed, the arc is automatically established simultaneously with the starting of the travel motor. Should the arc fail for any reason, the travel motor will stop without overtravel. The arc will re-establish itself and the travel motor will re-start, all without attention from the operator, thus insuring a continuously welded seam. An adjustable time limit switch stops the motor at the end of the weld and the carriage is returned to the starting position either by hand, or electrically by manipulating the push buttons. The carriage can be provided with an oscillator to be used when welding heavy plate.

The approximate dimensions are: Length, 3 feet, 6 inches; width, from front of apron to back of carriage, 2 feet, 7 inches; height above track, 2 feet, 6 inches, and weight, 800 pounds. Some applications for such a device are: Welding longitudinal seams in sheet steel tanks such as gasoline tanks, range boilers and transformer tanks, and in building up locomotive guide rods and other worn flat surfaces of all kinds.

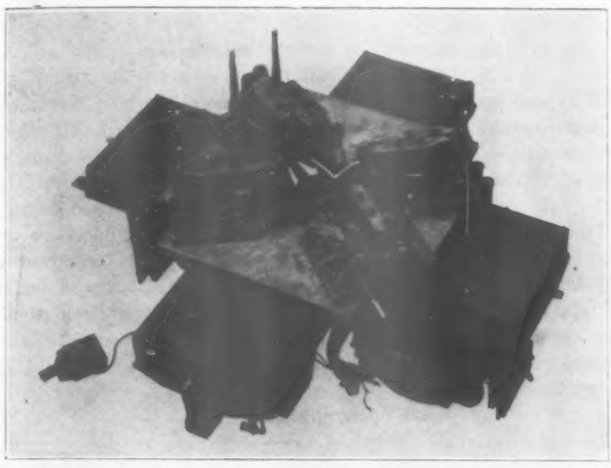
Some of the advantages claimed by the manufacturers for the automatic process of arc welding are economy of electrical energy; increased speed; superior quality as regards strengtn, solidity, ductility, uniformity and continuity; the production of certain welds impossible by hand welding; and general elimination of the personal element.

Welding Mitre Joints On Automobile Doors

A step nearer the realization of an "all-welded" automobile body has been made by The Federal Machine and Welder Company, Warren, Ohio, in its butt welder which is designed to weld mitre corners on automobile doors. The popularity which closed car models have been enjoying during the last few years, and which they are most likely to continue enjoying, causes the mak-

ing of such doors as that illustrated in the accompanying photograph to loom up as an appreciable item in automobile manufacture.

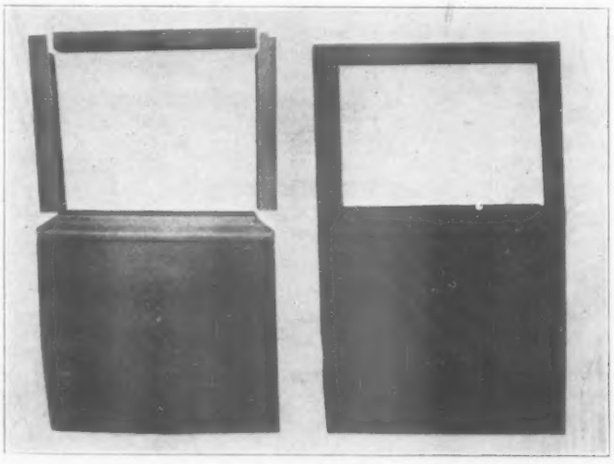
Welding of such doors or panels has been accepted as the best method of constructing them, and it has been used by manufacturers before, but the welding of each corner separately has entailed mechanical problems and difficulties. The machine illus-



Machine which welds four mitre joints simultaneously

trated here is designed to make all four corner welds simultaneously, eliminating, as the manufacturers contend, the difficulties encountered in welding each joint separately.

The time required for making the four welds is the same as that required for making one. The current consumed is four times that consumed in making one weld. The manufacturers claim that this may be off-set by distributing the machine over three phases of the circuit, giving a very slight unbalancing effect. Two separate transformers are used of 25 K. W. capacity. These have cast copper water-cooled secondaries.



The joints—before and after welding

Two men are required to operate the machine. The work is clamped in position by means of hand clamps, and after being adjusted to the proper position the operator trips a small lever which sets the automatic feature in operation. The current is thus applied for a pre-determined period of time, at the end of which the current is automatically shut off. This, the manufacturers claim, makes for a perfect weld and uniform thickness of flash each time.

Fig. 2 shows one of the panels before and after being welded by this machine. The particular panel here illustrated is approximately 18 inches by 24 inches, and the material is No. 9 gauge. The machine allows adjustment of six inches over and under the size mentioned.

WELDING A 1000 FOOT PIPE LINE

An ingenious application of electric arc welding was recently made by the master mechanic of the Northwestern Improvement Company at Roslyn, Wash. A 1000-foot pipe line was to be constructed.

A number of four-inch B. & W. boiler tubes had outlived their usefulness and had been consigned to the scrap heap. The pipe line to be constructed called for four-inch pipe and the boiler tubes were four inches outside diameter. Sleeves were cut from four-inch standard pipe about four inches long, into which the ends of the tubes, previously sawed off square, were slipped until they butted together. The ends of the sleeves were then welded solid to the tubes. A General Electric resistor arc welder was utilized.

Another line was constructed of Stirling tubes. These were 3¼ inches outside diameter, and nothing was available from which to cut sleeves. The damaged ends were cut off square, one end of each tube was brought to a red heat in a forge and then expanded by driving a mandrel into it about three inches. The plain end of the next tube was then forced in as far as it would go and welded.

No expansion joints were used as both lines were to carry water and were to be buried in a ditch. The ditch had a number of bends in its course, and, to avoid the use of flanges, the pipe was welded on supports over the ditch and then bent to conform to the ditch with a jack and chain, after which it was lowered into place.

FRENCH BOOKS ON WELDING

"Six Talks on Welding," and "Electric Arc Welding—Theory and Practice," are the names of two little books recently published by Publications de l'Office Central de L'Acetylene et de la Soudure Autogene, 104 Boulevard de Clichy, Paris.

The first mentioned of these is a collection of six addresses made before meetings of professional welders at the Central Office of Acetylene and Welding, Paris. These addresses cover the entire field of welding and cutting, dealing with the history of the process and its development to the present state, practical lessons in heat treatment of the various metals, regulation of welding and cutting flames, welding of different alloys, manipulation of welding equipment, etc. The book contains 150 pages and is generously illustrated with photographs and diagrams.

"Electric Arc Welding—Theory and Practice" is the work of M. Maurice Lebrun. He regards arc welding as a process still in its infancy, but one about which industrial engineers everywhere are eagerly seeking information and instruction. The book endeavors to supply just such information, and goes into the subject with great technical detail. The book contains some hundred pages and illustrations.

WESTINGHOUSE TO ISSUE NEW PUBLICATION

The Westinghouse Electric & Manufacturing Company will shortly release from the press "Westinghouse Achievements." This publication, consisting of some fifty pages, will describe and illustrate the company's activities and achievements during 1924. Detailed descriptions and attractive illustrations of various Westinghouse installations are contained in the advance press proofs submitted for review. The book is being prepared and edited by W. H. Cope, assistant director of engineering.

OBITUARY

Gust A. Peterson passed away on December 13th, at the age of 37, at his home in Oak Park, Illinois, after a brief illness of typhoid fever. He was born on a farm in Iowa in 1887 and came to Chicago in 1916, at which time he joined the Chicago Eye Shield Co., as a salesman of welding goggles. He was connected with this firm at the time of his death and his many friends in the welding industry will mourn his passing.

Standardized Hose Connections

Associations Accept Standard Designs for Torch and Regulator Hose Connections

RECENT activities in the acetylene industry indicate an acceptance of standardized hose connections for torches and regulators, making for interchangability in plants where a variety of torches and regulators are used.

Effort to bring this about was first started by the Gas Products Association when in June, 1924, a meeting of the Standardization Committee of the Apparatus Group was held. The committee consisted of A. J. Fausek of the Modern Engineering Company, St. Louis, Mo., Chairman; W. S. Noyes, Imperial Brass Mfg. Co., Chicago; W. A. Slack, Torchweld Equipment Company, Chicago; C. T. Price of the Gas Products Association, Chicago; F. J. Krein, Bastian-Blessing Company, Chicago; C. J. Coberly,

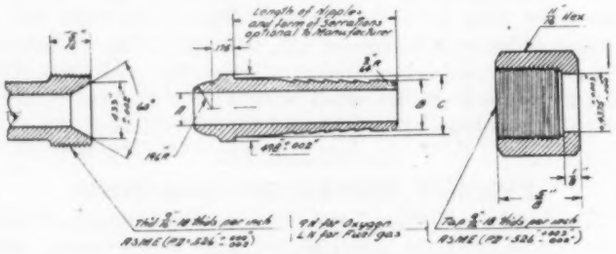

Length of Nipple and form of Serrations optional to Manufacturer
60°
Thd 7/8"-18 thds per inch
A.S.M.E. (P.D. .326" .002")
R.H. for Oxygen
L.H. for Fuel gas
Thd 7/8"-18 thds per inch
A.S.M.E. (P.D. .326" .002")

Fig. 1—Design for large size connections

Purox Company, Los Angeles; W. R. White and S. V. James of the Underwriters' Laboratories.

This committee was appointed by the Gas Products Association to consider and devise standard threads and designs for torch and regulator hose connections. It was the desire of the Gas Products Association to have some such standardized connections which could be recommended to the industry as a standard, so that users of equipment could avoid that difficulty which is encountered when various designs of equipment are used in the same plant.

After carefully surveying the entire subject and considering the various types of hose connections with their respective advantages and disadvantages the committee recommended to the Gas Products Association two connections of standard design, one to be known as a large connection for torches using ¼ inch hose and larger, and the other a small connection for torches using ⅛ inch hose and smaller.

For the large connection the design which is recommended specifies a ⅞ inch diameter right hand thread, eighteen threads per inch for oxygen, and a ⅞ inch diameter, left hand thread, eighteen threads per inch for fuel gas. For the smaller connection the design specifies a ⅜ inch diameter, right hand thread, twenty-four threads per inch for oxygen, and a ⅜ inch diameter, left hand thread, twenty-four thread per inch for fuel gas.

The committee drew up a report embodying these specifications and submitted it to a meeting of the Gas Products Association in its annual convention, held in Atlantic City on June 10, 1924. Upon acceptance of the report the secretary was instructed to approach the various manufacturers of welding and cutting equipment for their consideration of the committee's recommendations.

During the recent convention of the International Acetylene Association held in Chicago, November 12th, the oxy-acetylene and technical committees, in an open joint meeting, voted unanimously to approve standardization of hose connections for torches and regulators in accordance with the design submitted by one of the members, and which in its principal features agreed very closely with the standards as outlined by the Gas Products Association report. Some minor differences between the two standards existed in the curvature of the seat upon the hose nipple, and a slight variation existed in the over all diameter of this nipple. The essentials, however, were in agreement including the diameter, size of threads, and number of threads per inch for both large and small connections.

Figure 1 illustrates the design for large size connections and Figure 2 the design for small size connections, as approved by the International Acetylene Association, in its 1924 convention. It was also decided that the following paragraph be appended and considered a part of the specifications of these standards, certain of these being headed "Requirements" and others "Optional."

Requirements

In order that the proposed standardization of hose connections will insure interchangeability of parts made by various manufacturers, it will be necessary to require manufacturers to hold certain dimensions within the limits of standardized drawings, but so that the manufacturers can use their own judgment and follow their usual practice so far as possible they should be permitted to vary the rest of the design so long as it will not interfere with the interchangeability.

Standard

A. Size, type and kind of thread.

B. Angle and outside diameter of female seat.

C. Radius and distance of radius center of male seat from nipple shoulder.

D. Diameter of nipple shoulder.

E. Diameter of hole in nut.

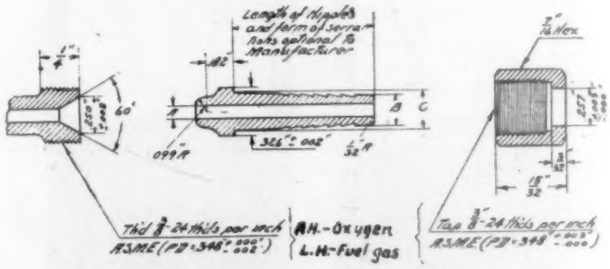

Length of Nipple and form of serrations optional to Manufacturer
60°
Thd 3/8"-24 thds per inch
A.S.M.E. (P.D. .348" .002")
R.H.-Oxygen
L.H.-Fuel gas
Thd 3/8"-24 thds per inch
A.S.M.E. (P.D. .348" .002")

Fig. 2—Design for small size connections

F. Small and large diameters of hose nipple.

G. Diameters of drilling through nipple.

Optional

A. Material, strength equal or greater than free turning high brass.

B. Diameter of drilling through male fitting.

C. Form of end of nipple except seating section as covered in "C" under standard.

D. Length of hose nipple.

E. Type and number of serrations on hose nipple.

F. A second shoulder equal to the large diameter of the largest nipple to extend through the hole in the nut for appearance, to be used or omitted for smaller diameter nipples.

G. Length and location of hexagon section on nut.

The resolution further provided that the International Acetylene Association urge the general adoption of this standard by

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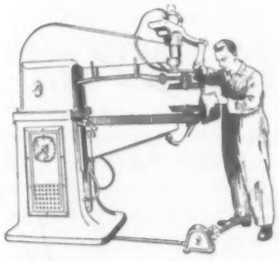

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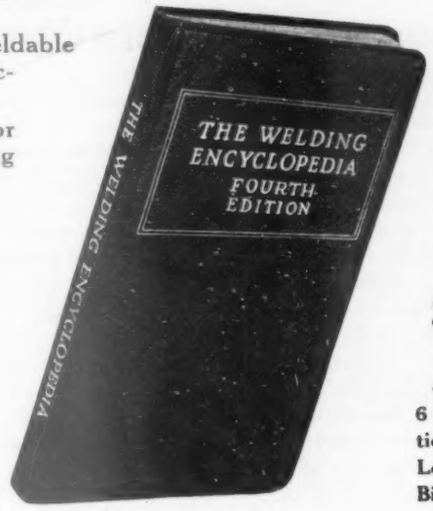

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all apparatus manufacturers in the United States, and that the Association, itself, endeavor to obtain the adoption of this standard by the various interested regulatory bodies.

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7/16 in.	.187 in. +.002 in. −.000 in.	.3125 in.	.375 in. +000 in. −.005 in.
1/4 in.	.125 in. +.002 in. −.000 in.	.250 in.	.312 in. +.000 in. −.005 in.
7/16 in.	.093 in. +.001 in. −.000 in.	.187 in.	.250 in. +.000 in. −.005 in.
1/8 in.	.062 in. +.001 in. −.000 in.	.125 in.	.187 in. +.000 in. −.005 in.

Hose	A.	B.	C.
7/16 in.	.093 in. +.001 in. −.000 in.	.187 in.	.248 in. +.000 in. −.005 in.
1/8 in.	.062 in. +.001 in. −.000 in.	.125 in.	.187 in. +.000 in. −.005 in.

ELIMINATING THE OXYGEN WASTE

(*Continued from page* 29)

to 1 gramme. Typical oxygen regulators as used in practice were used for the tests.

The figures for the consumption and time shown in the graphs, represent the averages for three cuts made under the conditions mentioned. Graphs have been drawn for each of the seven thicknesses of plate on which experiments were made, viz:—7/16, 1/4, 3/8, 1/2, 5/8, 3/4 and 1 inch. Certain of these graphs, as for example, those representing cuts on 3/8 and 3/4 inch material, show that more tests were made than with other sizes.

These graphs are divided into two parts, the upper graph shows the consumption of oxygen per square inch and the consumption of oxygen per foot run. The size of orifice used to obtain a particular graph is also shown on the verticle scale, while the horizontal scale shows the pressure of oxygen used. The lower graph shows the time and size of orifice plotted against the pressure of the cutting oxygen. It is easy to find, by means of each graph, the size of orifice and the oxygen pressure required to obtain the mimimum cost for cutting any thickness of plate for which the graphs have been obtained.

It is interesting to note how the time factor is reduced as the oxygen pressure is increased while at the same time the oxygen consumption is increased. The criterion in each case is to select a minimum consumption to agree with an acceptable time of execution as it is possible to obtain an appreciable increase in gas consumption for a slight gain in cutting speed.

It has been pointed out that the plotted data is the average of three tests and it is perhaps necessary to mention that the difference between the average and the highest and lowest values obtained was 6 per cent or 12 per cent difference between the extreme values.

The interesting points which emerge from a consideration of the graphs are first, they indicate, with a sufficient degree of industrial accuracy, the time required and the gas consumption obtained when using a series of cutting nozzles with different pressures. A comparison can be made immediately by looking at the particular group of graphs which apply.

Secondly, it is possible to determine, for any particular thickness of plate, the pressure and size of orifice corresponding to the best economy. Thirdly, the graphs indicate whether it is preferable to cut with a high pressure and small orifice or to increase the nozzle orifice and reduce the pressure. The first of these conditions should be made. Fourthly, they confirm the results obtained previously by showing that up to a certain point increase of cutting pressure is accomplished by an increase of cutting speed, and fixes for each case the pressure at which the speed ceases to increase. Lastly, the accompanying Table shows as a summary the conditions under which the seven plates under consideration were cut.

In the two final graphs the consumption of oxygen per foot run and the time required to cut one foot of each thickness of plate are shown by means of a single graph in each case.

It is possible to deduce from these tests that under what can be termed industrial conditions, the average consumption of oxygen for plates from 7/16 to 1 inch in thickness is 0.25 cu. ft. per sq. in., with a minimum of 0.23 cu. ft., and a maximum of 0.28 cu. ft.

These consumption figures may be reduced by using oxygen of 97 per cent purity which is the minimum in use at present, or by oxygen of 98 per cent purity which can be obtained. Some experiments have been made on these lines and, at the moment, it can be stated that when using cutting machines on material varying from 7/16 to 1 inch in thickness the consumption of oxygen per square inch of cut is of the order 0.18 cu. ft., and with hand cutters 0.25 cu. ft.

M. Piette in conclusion states that the results obtained from these researches will form the starting point for a series of further researches which he indicates.

WELDING RODS AND FLUXES

The Suffolk Iron Foundry of Stowmarket, England, has recently issued a new catalog entitled "Welding Rods and Fluxes." It is very attractively printed and illustrated and the cover has a unique illustration called "Welding the World" in which a large crack in the globe is being welded by the use of welding rods manufactured by this company. The booklet consists of 16 pages printed in two colors dealing with the products manufactured by this company and the oxy-acetylene welding process in general. Discussions are given on the Elimination of the Scrap Heap, Preventing Costly Stoppages, Preparation of Castings, The Welder, The Handy Man, Welding Rods, Various Welding Jobs, Hints to Welders and Useful Data for Welders. This little booklet may be had by writing to the company.

COMPRESSED GAS MANUFACTURERS' ASSOCIATION TO HOLD MEETING IN NEW YORK

The Compressed Gas Manufacturers' Association will hold its twelfth annual meeting on January 26, 1925, at the Hotel Astor, New York City, according to a notice received from John H. Luening, secretary of the Association. The meeting will be followed by the annual dinner on the evening of the same day.

CORRECTION

In the *"News of the Welding Trade"* column of the November issue, *The Welding Engineer*, it was announced that the Clark Chemical Company of Wickliffe, Ohio, was planning to install a Levin plant. This was incorrect. The plant purchased was an Oxeco, furnished by M. Keith Dunham, Chicago.

G. P. A. TO HOLD MEETING

The Mid-Winter Meeting of the Gas Products Association will be held in Chicago on January 22, 23 and 24. Complete details will be announced in the January issue of *The Welding Engineer*.

News of the Welding Trade

The Canadian Section of the Compressed Gas Manufacturers' Association held its fourth annual meeting on December 2, 1924, at the King Edward Hotel, Toronto, Canada.

The Standard Supply and Equipment Company, 143 North Warren Ave., Trenton, N. J., has been organized as jobbers in railroad, mine, mill and contractors' supplies, tower transmission and automotive equipment.

Linde Air Products Company, New York, announces the opening of two new district offices, one at 210 Dooly Block, Salt Lake City, Utah, in charge of R. L. Strobel; the other at Seattle,

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Electric Arc Welding, by E. Wanamaker and H. K. Pennington. The book covers descriptions of welding systems and their installations, phenomena of the metallic and carbon welding arc, training of operators, methods for applying metal to various types of joints and building-up operations, electrode materials used, weldability of various metals, weld composition, thermal disturbances of parts affected by the welding process, physical properties of completed welds, efficiency of welding equipments, welding cost, etc. 254 pages, 167 illustrations. Size 5 in. x 9 in. Bound in cloth. Price $4.00.

Arc Welding Hand Book—"The Arc Welding Hand Book" by C. J. Holslag, Chief Engineer, Electric Arc Cutting & Welding Co., has just been published by the McGraw-Hill Book Co., New York City. This book is attractively bound in red imitation leather and is comprised of 250 pages and numerous illustrations. It is intended to serve as a simple and practical instruction in arc welding, and an attempt has been made to describe the methods, step by step, so that the beginner may understand both the equipment and the process. To the engineer, draftsman and designer, it should serve as a guide in the use of arc welding. The contents consist of 25 chapters which discuss all phases of arc welding. Price $2.00.

Cutting Iron and Steel With Oxygen, by M. R. Amadeo—A thorough treatise on the use of the cutting torch. Describes apparatus used and methods of operation. Tells influence of oxygen impurities, cutting pressure, effects of preheating cutting oxygen and discusses the heating flame, torch construction, cost of cutting, and cast iron cutting. It is very well illustrated and has many useful cutting tables. Price $1.50.

British Acetylene and Welding Handbook, by a Committee of the British Acetylene and Welding Association. Contains historical and scientific data relating to acetylene, oxygen and carbide. Treatises on the application of acetylene and oxy-acetylene welding and oxy-acetylene cutting. Tests, specifications, regulations, transport conditions, etc., and also the complete reference on acetylene and acetylene welding. Bound in cloth. Price $3.00.

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The Auto Sheet Metal Works, 2004 Main Street, Los Angeles, California, manufacturers of auto tops, bodies, auto sheet metal work, bumpers, hoods, tanks, etc. have awarded a contract for the construction of a one story building, 100x100 feet on South Park Avenue.

The Board of Directors of the International Oxygen Co., of Newark, N. J., declared a dividend of 3 per cent on all outstanding stock, at a recent meeting.

The Milburn Sales Company who are Distributors for the Alexander Milburn Company, manufacturers of Oxy-Acetylene Welding and Cutting Apparatus and Portable Carbide Lights, in the Philadelphia Territory have now taken over the Metropolitan New York District with headquarters at 309-11 Fifth Avenue. Mr. E. P. Boyer, Mr. D. Keyser, and other assistants will be in charge of activities there.

The Gibb Instrument Company of Bay City, Michigan, has changed its name to Gibb Welding Machines Company. This is a change in name only and denotes no change in organization. As the company no longer makes instruments but is engaged exclusively in the manufacture of electric welding and heating machines, the new name was adopted as more exactly descriptive of the product.

H. V. Beronius has been appointed representative in Iowa, Kansas, Nebraska, Oklahoma and Northwestern Missouri, with headquarters at 33 Linwood Terrace, Kansas City, Mo., for the Gibb Welding Machine Company, Bay City, Mich.

G. E. Emmons has resigned his position with the General Electric Company and will leave Schenectady for his home in Pasadena, California. Mr. Emmons has completed a forty year term of service with the General Electric Company and its predecessors.

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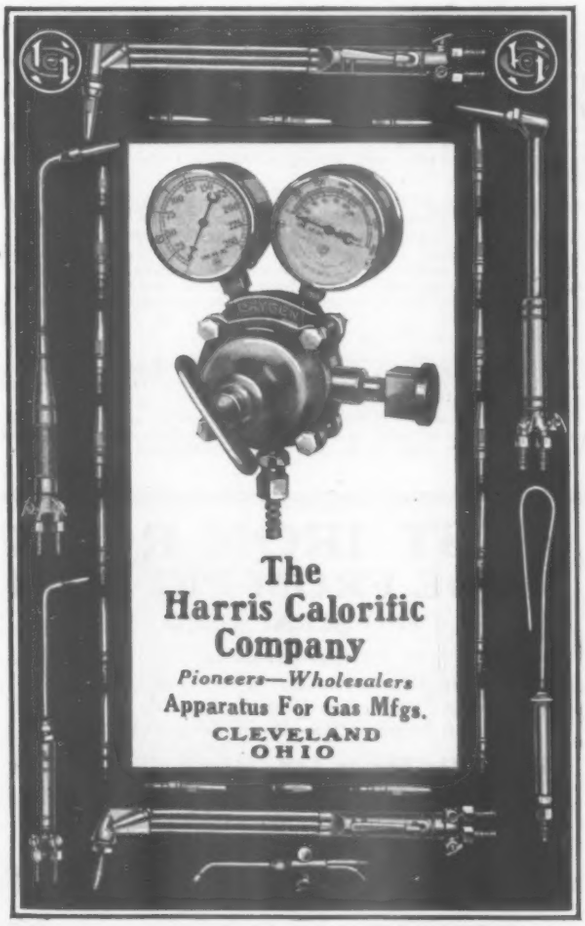

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CURRENT WELDING LITERATURE

TORCH AS APPLIED TO THE MANUFACTURE OF ICE MAKING MACHINERY, by John J. Hilliard.—Tells how Longitudinal weld in ammonia receiver departs from usual practice of offsetting in adjacent sections and has weld in one line throughout its length. Describes bronze welding of galvanized iron. Receiver stood test of 800 lbs. water pressure and 250 lbs. air pressure. Characteristics of galvanized iron not lost in welding.—Acetylene Journal, December, 1924.

OXY-ACETYLENE WELDING AND CUTTING FOR STUDENTS—Third of series of lectures upon welding and cutting intended for the student. All gasses compressible. Pressure reducers or regulators. Regulating working pressures. Principles of gauge operation. Never test oxygen gauges with oil. Care of regulators. de l'Acetylene, September-October, 1924.

GASES FOR HEATING AND MOTORS—An examination of the value of various gases for heating and power purposes. A combustible gas which can be used for lighting, heating and power purposes should be studied from the point of view of (a) calorific value; (b) heat of combustion, and (c) potential thermal value. These three aspects are fully dealt with and tabulated data is given showing the relative values of these for ten combustible gases.—Journal de l'Acetyelen, September,-October, 1924.

CONTROL OF WELDS IN WORKSHOPS—The necessity of examining the underside of welds in boilers, pressure vessels, etc., is appreciated and the use of mirrors for this purpose has been described. A device used by the Oerlikon Company for examining the internal parts of turbo-generators is illustrated and described and the extension of its use to welding, especially in places where it is impossible to examine the weld for penetration, cracks, etc., is suggested.—Acetylene et Soudure Autogene (Suisse) October, 1924.

BOILER REPAIRS USING THE BLOWPIPE AND ELECTRIC ARC—The complete paper read before the 8th International Congress of Acetylene and Autogenous Welding, on the important factors to be considered when using the blowpipe or electric arc for boiler repairs. The paper is divided into four sections, viz.:—(1) principal characteristics to be considered in welding steam boilers; (2) strength of welds; (3) defects of boiler welds; (4) standards required for welders carrying out boiler repairs. Conclusions are drawn accompanied by the statement that the French Association in conjunction with the Associations of other countries has drafted a series of recommendations relative to the use of the blowpipe and electric arc for this class of work.—Revue de la Soudure Autogene, August-September, 1924.

OXY-ACETYLENE APPLICATIONS—An illustrated article showing the use of the oxy-acetylene process for the manufacture of metal bedsteads. Various details of the construction are shown and its economic value in the particular factory specializing in this field is emphasized.—Revue de la Soudure Autogene, August-September, 1924.

OXY-ACETYLENE EXAMINATION QUESTIONS—Six questions with full solutions set at the annual examination for the welding diploma at the Polytechnic Institute, Nantes. The solutions, accompanied by sketches, are those of one of the best candidates. A typical question was "The welds handed to you have been made by the oxy-acetylene process. Indicate (a) the defects of these welds; (b) how you have determined the defects, and (c) on what grounds would you refuse to pass the welds?"—Revue de la Soudure Autogene, August-September, 1924.

TESTS FOR WELDS—An examination of the various methods used in testing welds in which a new kind of test is indicated, this is a tensile test parallel to the line of welding. This test, as is shown by data and diagrams, is exceedingly valuable and likely to become a standard test in future. The author points out the importance of carrying out tests of various kinds so as to be in a position to form a judgment as to the admissibility of welded joints in particular classes of work.—Acetylene et Soudure Autogene (Suisse) October, 1924.

ARC WELDING IN ROLLING MILLS—An arc welding set is indispensable in rolling mills. Typical repairs are shown and data given as to the dimensions and time required for repair.—Revue de la Soudure Electrique Autogene (Belgium) August, 1924.

WELDING ELECTRODE—A 12-page booklet issued by the General Electric Company, Schenectady, N. Y., and bearing the designation Y2019, describes the new Type A General Electric welding electrode. Details are given on electrode construction and characteristics. Results of tests on welded cast iron specimens and deposited metal specimens are described, and oscillograms demonstrating arc stability are reproduced. Instructions for the use of the electrode are supplied and specifications of the standard sizes given.

EYE HAZARDS IN INDUSTRIAL OCCUPATIONS, by Louis Resnick and Lewis H. Carris.—Published by the National Committee for the Prevention of Blindness, Inc., 130 East 22nd St., New York City. This two hundred and thirty-three page booklet is a most comprehensive study of eye hazards in various industrial plants in the United States and the preventions urged as well as the treatments given for injuries. Illustrations show the masks, eye goggles, and other equipment for workmen, and the guards used on machines.

WELDING AS THE METHOD OF FABRICATING LARGE STRUCTURES, by H. Goldmar, W. Spraragen, and W. L. Warner—An article comparing the use of welded joints in structural work to riveted joints and the listing of the advantages by welding. Simpler designs and drawings, less preparation of material, ease of erection. Saving in weights is possible while accurate alignment is not necessary. Elimination of noise and other factors considered. Saving in freight and handling. The articles gives the result of a number of tests along this line and comparison shows the advantages of welding over riveted joints.—Journal of American Welding Society, November, 1924.

WELDED JOINTS FOR CASTIRON PIPES—A comprehensive article describing the growing popularity of bronze welding of cast iron pipe. The article cites a case of 80 miles of 8 in. pipe built in 100 working days in rainy season across unfavorable land, which when finished had only four leaky joints under 740 pounds pressure. A discussion of different types of pipe joints which may be handily bronze welded. Illustration of sledge hammer tests of bronze welded joints in which pipe itself cracked but all pieces still adhered to the weld. Results of tests in bending great lengths of this welded pipe showed a desirable flexibility but a more desirable durability. Description of pipe line laid for the Long Island Gas Company in which the pipe was welded into a continuous length and then lowered into the trench. Approximately half this line was joined before the pipe was strung along the trench.—Oxy-Acetylene Tips, November, 1924.

ALL WELDED STEEL BUILDING, by J. W. Turner—Description of the building of two buildings, additions to the plant of the General Boilers Company, in which the parts of the structure were electric arc welded. Discussion of advantages over riveted joints. Detailing made easier, fabrication cheaper, certain members eliminated, harder flexibility and more economically erected. Article gives as absolute strength of weld 38,000 pounds per square inch, safety depending upon amount and type of stress.—Journal of American Welding Society, November, 1924.

OXY-ACETYLENE WELDING IN HIGH PRESSURE GAS LINE—Article describing the laying of North Shore Gas Company's high pressure transmission line and extension with welded joints. The line approximately 26 miles along shore towns of Lake Michigan. Pipe delivered on ground in 20 foot lengths. Three crews of welders handled the job.—Oxy-Acetylene Tips, November, 1924.

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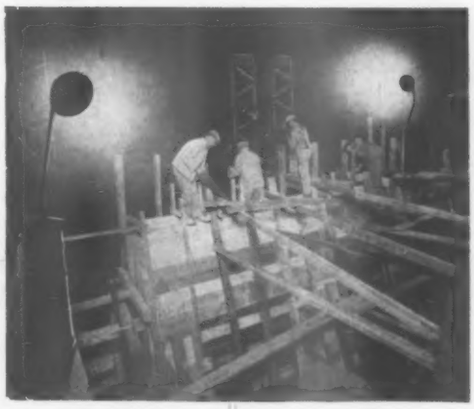

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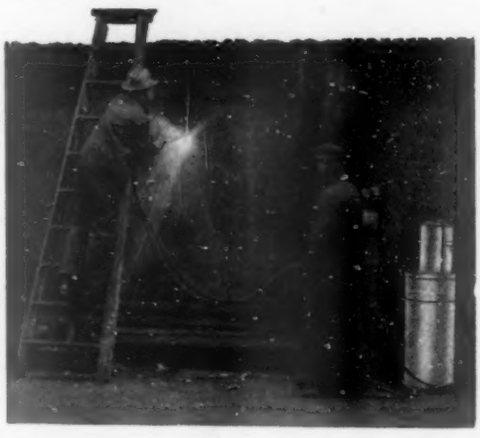

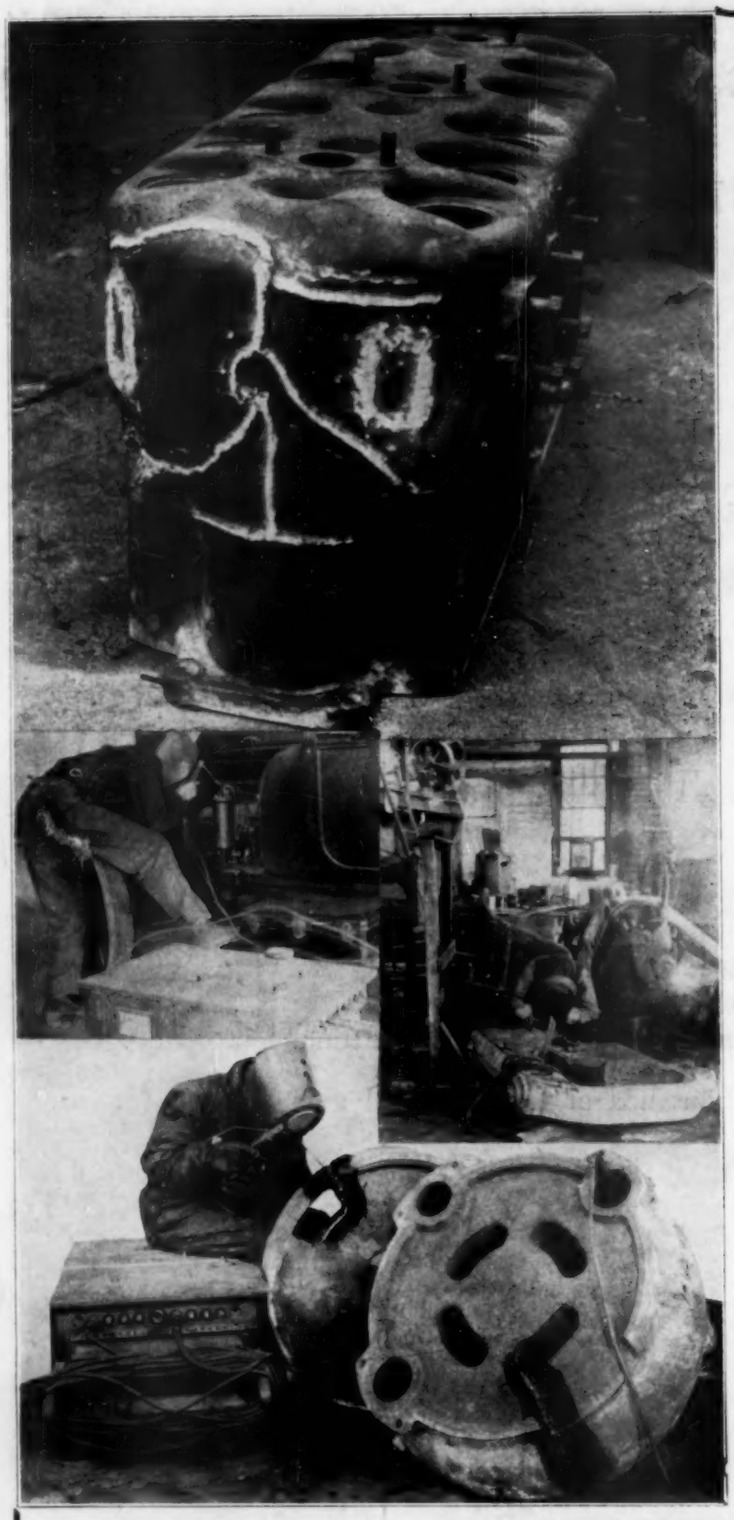

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